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ABSTRACT

Intended for use by training professionals with little or no background in the application of automated data processing (ADP) systems, processes, or procurement requirements, this reference manual provides guidelines for establishing a computer based training (CBT) program within a federal agency of the United States government. The manual covers: (1) needs assessment; (2) the technical components of a formal feasibility study, as required by federal ADP procurement rules; (3) obtaining management approval; (4) implementation planning, in order to meet the additional federal ADP procurement requirement for a system proposal; (5) prototype system development; (6) courseware development; and (7) the evaluation and maintenance of CBT systems. A flow chart giving an overview of the process of implementing CBT programs is provided. Appendices present a list of 141 references and resources; a 121-item glossary; lists of relevant organizations, associations, consortia, networks, vendors, systems, and languages; summaries of current CBT programs in federal agencies; a table outlining current CBT activities in federal training; and a list of the Federal Interagency Group for Computer-Based Training (IGCBT) organizations and contacts. (ESR)

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Computer-Based Training Starter Kit

Compiled by
The Federal Interagency Group
for Computer-Based Training

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COMMENTS

This document is a final draft being circulated among federal and private organizations for comment. Comments will be incorporated into the succeeding publication. Please forward all comments by October 1983 to:

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1. INTRODUCTION

Why a Starter Kit?

Computer-based training (CBT) is making far-reaching improvements in the way organizations solve their training needs. However, establishing a CBT program is a complex task requiring extensive planning, resources, organizational adjustments, and top management commitment. It is a task involving many new or possibly unfamiliar issues and potential pitfalls to unsuspecting trainers.

This Starter Kit is based on the collective experience of the Federal Interagency Group in Computer-Based Training (IGCBT). As much as we wish it were otherwise, it is the consensus of the IGCBT that the general process outlined in this Starter Kit cannot be short cut without great risk. We simply hope that the Kit will make the job of initiating or managing a CBT program a bit easier.

While the Starter Kit includes a variety of subject areas which are essential to successful implementation of a CBT program in Federal agencies, we believe it will be a worthwhile reference to the private sector as well. The kit is written for training professionals who, although appropriately assigned to manage a CBT program, come to the assignment with little or no background in the application of Automated Data Processing (ADP) systems, processes, or procurement requirements.

About the IGCBT

The IGCBT was formed in 1978 by individuals from the Office of Personnel Management and several Federal agencies then exploring the feasibility of CBT (or conducting CBT research). The main objective of the group is to exchange information and share resources. In keeping with this objective several participants contributed to this Starter Kit to help organizations just beginning CBT programs. As such of the material in the Kit is based on approved documents from successful programs designed by our members, the reader may find some variance in style and approach from chapter to chapter.

The IGCBT meets on the last Tuesday of each month. Meetings are open to Federal employees. Persons from non-Federal organizations may also attend through prior arrangements with the chair of the IGCBT. Inquiries about the IGCBT should be directed to:

Larry Westburg, Patrice Walker or Sue Middendorf
Office of Personnel Management
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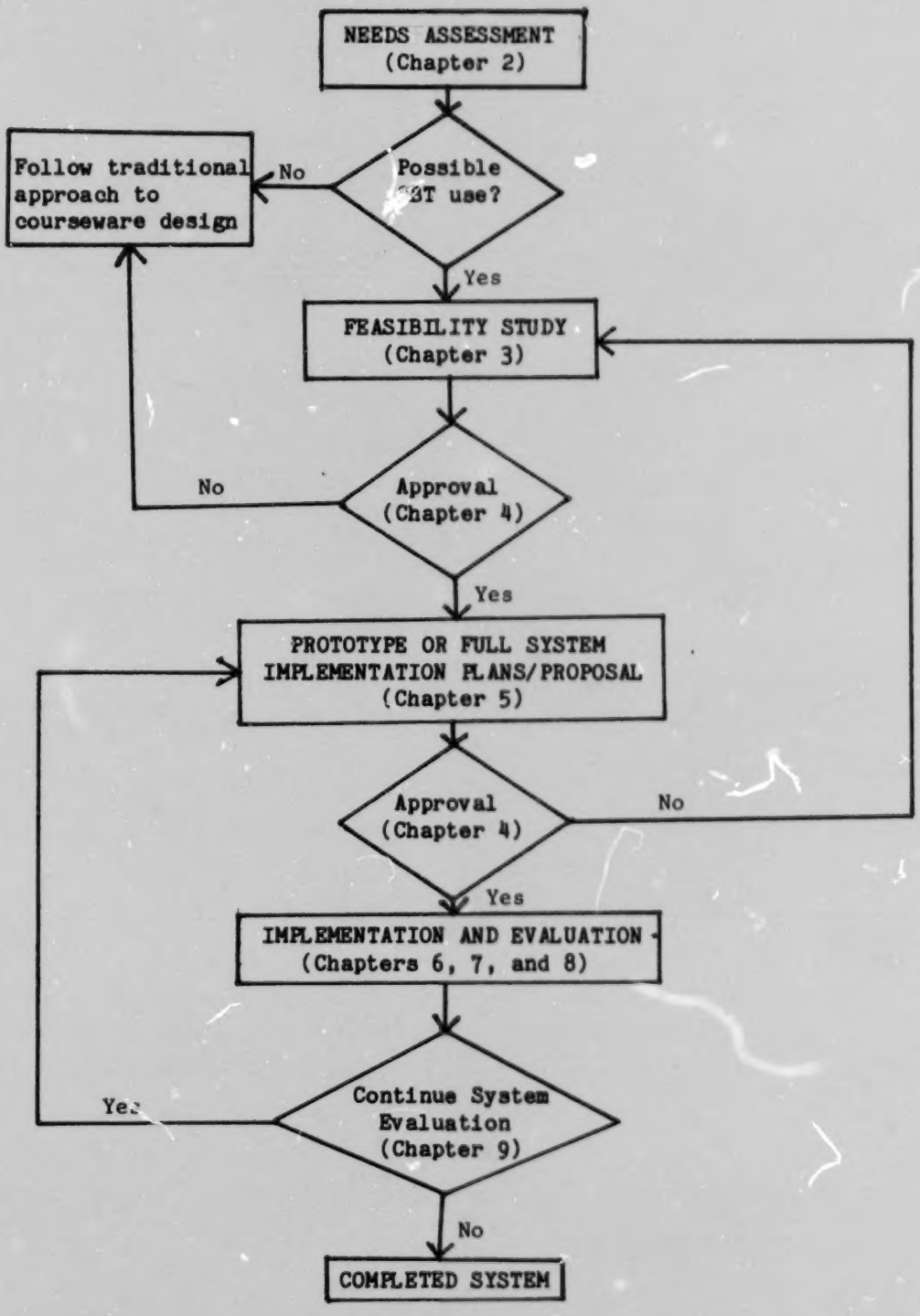
(202) 653-7055

The opinions expressed in this Starter Kit are the opinions of the individuals involved and not necessarily the opinions of the organizations which employ them.

Overview

Computer Based Training (CBT) is an all-inclusive term for training that is both delivered directly by computer (Computer Assisted Instruction, CAI) and training that is managed by computer (Computer Managed Instruction, CMI). The IGCBT recommends implementing CBT programs through the systematic process outlined in Figure 1-1. The process begins with a systematic and basic assessment/validation of training needs, which must precede any proposed major change in a training program (chapter 2). Most professional trainers will be familiar with this phase of the process. Because CBT falls within the scope of Federal ADP procurement rules, a formal feasibility study is required. Chapter 3 describes the technical components for such a study in accord with standard requirements. Chapter 4 recommends an approach for winning management approval with the least "pain" and controversy. Chapter 5 describes an approach for implementation planning which meets the additional Federal ADP procurement requirement for a system proposal. Note: some organizations may have only one formal management approval step for the feasibility study and system plan. Chapters 6, 7, and 8 offer advice on how to conduct prototype projects, design courseware, and evaluate your CBT system. Chapter 9 ends with the point that CBT systems, unlike most conventional ADP systems, should evolve. The planning and implementation process should be carried through many cycles as the organization adjusts to and gains experience with CBT.

Figure 1-1. Overview of Starter Kit



2. NEEDS ASSESSMENT

The determination of whether to use new technology for training must begin with an analysis of what the training needs are and how well they are being fulfilled by the present system.

In the application of instructional system design, a training needs analysis begins ideally[1] with a comparison of the objectives or requirements for either the proposed or existing training with a recent job task analysis. To be valid, the training objectives should be derived directly from the process of job task analysis.

The process of job task analysis involves documentation of the complete inventory of job functions performed in a particular job specialty[2]. Each of the tasks is then categorized in terms of values that differentiate the importance of each function to the performance of the job, such as frequency of occurrence, criticallness, etc. All tasks are then grouped appropriately in terms of knowledges and skills that are required in order to perform the functions they represent. Training and job proficiency levels are then established based on the degree to which a new recruit or trainee should be able to perform in comparison to the performance expected of a fully competent performer (journey level). For further information examine the Interservice Procedures for Instructional System Development Model (ISDM) (U.S. Training and Doctrine Command Pamphlet 350-30) available via GPO, or other relevant publications on job task user task analysis. (See reference list, Appendix A.)

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[1]Ideally is used here because trainers often find that a lack of time and/or resources prohibits them from utilizing this technique, rational and logical as it is.

[2]When resource constraints prohibit job task analysis, a job function analysis (JFA) is sometimes performed. This process contains much less detail than a job task analysis. A JFA is based upon job functions, but may be assembled by a review of organizational directives, official position descriptions, limited interrogation of field experts, and other locally available expertise.

Effectiveness, Efficiency and Cost

Assuming that current training objectives have been derived from a valid job task analysis, the next question to ask is whether conventional classroom or other training delivery methods are currently effective, or stated another way, are employees performing satisfactorily? If the answer is yes, or if there is no information available, then the cost and/or effectiveness of various training alternatives should be examined.

However, an examination of the cost/effectiveness of CBT (or some other new technology) could also be motivated by a desire to maximize training effectiveness to reduce or minimize overall training costs and/or the time required to attain various levels of proficiency. A common reason for using computer-based instruction is an expected reduction of student and instructor time and the resulting cost savings. However, other equally or more important benefits may include training effectiveness (without which a cost reduction is meaningless); standardization of course delivery; simulation of computer related job environment; modularization and individual pacing to accomodate varied entry levels, job responsibilities and learning skills; automated test grading and record keeping; ease in delivery of course changes and adaptations; and remote delivery capability in field or on-the-job locations.

If your current training system is operating effectively, you will need to make a detailed analysis of that system to make a determination of whether it would be cost beneficial to move to CBT or other new technology as a delivery or management medium. To help you conduct that analysis we have provided a list of training system functional requirements later in this chapter. However, if employees in the organization are not performing current job tasks satisfactorily, you must first conduct a performance analysis.

Performance Analysis

This process causes the training manager to explore whether the proposed training need is valid. That is, is there a need for the employee to increase his or her level of knowledge or skill in the job task or is

the performance deficiency related more to environmental conditions, lack of motivation or other organizatinal factors which inhibit adequate performance, such as the way a job task, or function or procedure is constructed or managed? For additional information on conducting a performance analysis, consult the relevant publications by Robert Mager and J. H. Harless (See Appendix A).

If the performance analysis helps to document a valid training need that is not being met by the current training process, then an evaluation of alternative training delivery and/or training management techniques is in order. (The reader may want to review the inter-service ISD model (op. cit.) for information on selecting instructional delivery systems, or look at the training system function requirements in the following section). Once these preliminary steps have been taken and CBT is considered a valid option for training delivery and/or training management, the reader is advised to follow the recommendations included in Chapter 3, Feasibility Study.

Training System Functional Requirements

The following list/checklist of important aspects of an instructional systems design (ISD) -based training system may be assistance in diagnosing whether your current or proposed system of training is effectively addressing your agency's performance requirements. This type of analysis should also help you later when you have to functionally describe CBT system requirements.

Following job task analysis and training needs analysis, ISD-based training systems can be divided into seven functional areas and the requirements established for each. They are:

--Course development
--Lesson delivery
--Testing
--Recordkeeping
--Managing student progress
--Course maintenance and revision
--System and program interfaces

Course Development. The training system must provide for course development which:

1. Follows the instructional systems design model (i.e., training plans and lessons are designed to meet the specific requirements of a job standard or analysis contained in a training proposal).
2. Supports modularization of courses.
3. Allows simultaneous lesson delivery and development activities.
4. Allows for dynamic growth, improvements, and maximum utilization of available methodology/technology, e.g., simulators.
5. Allows for the use of already developed outside course material.

Lesson Delivery. The training system must provide for lesson delivery which:

1. Ensures standardization.
2. Has the ability to teach cognitive and procedural skills through the following kinds of learning: specific responding, motor chaining, verbal chaining, discriminating, classifying, rule using, and problem solving.
3. Specifies procedures for conveying information that impacts on the more emotional or affective dimension of learning. This learning might include human relations, supervisory/employee transactions, optimal (satisfactory) productive, motivation, EEO and/or LMR.
4. Allows the student to move through the course material as quickly as possible and at the highest level of quality possible. This is accomplished using a variety of techniques.

   --Modularization
   --Individualized instruction
   --Immediate feedback
   --Interactive lessons
   --Use of multi-media techniques
   --Efficient student counseling
   --Use of motivating lesson material and training media.
   --Use of high transfer simulations and games.

5. Allows for the identification and analysis of courseware problems.
6. Allows simultaneous delivery of multiple lessons.

7. Frees instructors from repetitious classroom teaching or course management activities.

8. Is readily accessible to students (and course graduates for refresher training).

Testing. The training system must provide for testing which:

1. Measures student mastery of instructional objectives through questions or skills demonstrations.

2. Measures student progress in a valid and reliable manner.

3. Is scored quickly to provide feedback and timely lesson assignments.

4. Is secure from compromise.

5. Prevents the student from "test question learning" through random generation of a variety of questions, problems or skill performance situations. ("Test question learning" may occur if students are repeatedly exposed to the same testing materials.)

6. Provides statistical analyses necessary to determine question validity and reliability.

Recordkeeping and Analysis. The training system must provide a recordkeeping function which collects the data and performs the statistical analyses necessary to:

1. Determine individual student and group progress, accomplishment and grade.

2. Schedule students and manage training resources.

3. Determine validity and reliability of test questions.

4. Analyze instructional effectiveness.

5. Determine instructional costs.

6. Develop, maintain and revise courseware.

7. Develop course or program evaluation and activity reports.

Managing Student Progress. The training system must provide for management of student progress by:

1. Identifying entry level.

2. Generating individual lesson assignments.

3. Identifying need for student counseling.

4. Predicting and analyzing student progress.

5. Providing warning when a student is not progressing as scheduled.
6. Monitoring many students simultaneously.
7. Providing administrative structures which motivate students to complete course in a timely manner.
8. Allowing an instructor to handle a large number of students.

Course Maintenance and Revision. The training system must provide for course adjustment, maintenance and revision through:

1. Complete and self-explanatory documentation of course material development to ensure continuity.
2. Systematic updating of all distributed course material.
3. Course modularization.
4. Analysis and reporting mechanisms to identify course deficiencies precisely.
5. Easy updating process.

System and Program Interfaces. The training system must provide for interfaces with related administrative and operational programs and provide a means of handling or adopting the considerations of the learning environment by:

1. Providing flexibility to handle fluctuating number of students.
2. Supporting instructor and student learning and career growth.
3. Providing efficient transfer of data to other information systems.
4. Minimizing the amount of time employees are absent from the job site due to training.
5. Operating with common-use, continuously updated and improved systems so that the agency may readily contract for course development and exchange courseware with other Government or private training institutions.

3. FEASIBILITY STUDY

Once your have decided that a CBT system might meet your organization's training needs you will need to secure the necessary procurement authority to obtain a computer system for which a feasibility study will be required. This is normally reviewed by all levels of an organization, and then by General Services Administration (GSA). The extensiveness of the review generally depends on the dollar amount of the procurement.

This section explains what is required in a feasibility study, and describes three other studies which are usually attached to or related to the feasibility study. They are the telecommunications study, the A-76 analysis (based on the Office of Management and Budget's Circular A-76), and a systems study. Although these are required government procedural documents, elements of these studies probably will be required of anyone who is attempting to acquire a CBT system for his or her organization. Note that all of the study requirements ask the proposer to describe a system in ADP terms. This is a problem for trainers who are not accustomed to describing their incorrectly responding students as "outputs". Care must be taken to avoid confusion between an "instructional" system and a "computer" system.

Study Components

Each computer systems feasibility study should include the following information:

Title. Include the full name of the computer system and acronym if one is used, e.g., Computer-Based Training System (CBT).

Identification. Indicate originating office, including geographical location, parent organization, and preparation date.

Problem Statement and Relation to Mission. Define the training problem or need in specific, clear terms. Use quantitative data if possible. If the requirement is for additional resources for an on-going system, indicate accomplishments to date and the need for continuing the project.

Provide rationale to explain why the problem is one which the organization must try to solve. Explain how the accomplishment of the organization mission has been adversely affected by the problem.

Problem Analysis.

1. **Description.** Describe why the problem is occuring and the consequences. For example, an increase in workload may not be a problem if the existing staff or systems can handle it within the necessary performance standards. The basis for workload forecasts should be defined in terms of how they relate to staffing and budget requests. For on-going computer systems and equipment upgrades, provide a summary report which highlights the critical points and the rationale for change. The report should be based on a minimum of three months of recent quantitative performance evaluation data.

2. **Magnitude.** Describe who the problem affects and how wide-spread the problem is. Identify as specifically as possible the population affected.

3. **Casual Factors.** Discuss the factors causing the problem. Are they beyond the organization's control? Are they likely to persist or are they temporary?

4. **Data Sources.** Identify sources of the data on which the conclusions stated in the Feasibility Study are based. Where necessary, full documentation of the data sources may be required.

Detailed Analysis of Proposed Program or Detailed Requirements Analysis

1. **Objectives.** State the objectives of the proposed program in measurable, quantitative terms, e.g., implement CBT (proposed system) in three cities, or train so many employees in a specified time frame.

2. **Expected Accomplishments.** If the objectives are achieved, to what extent will the problem be resolved, e.g., increase student mastery levels by 10 percent.

3. **Assumptions.** Discuss the assumptions on which the proposed program is based.

4. **Description.** Describe how the proposed program will work and how it will alleviate the causes of the problem. Discuss those things that will be done to implement the program, who will implement it, and how the steps will be accomplished. Be specific and provide details. A high-level flow chart and a narrative description of the major steps and their relationship in the proposed program should be provided. Indicate the flow of information and the relationship with users and other systems. Describe each major input and output in terms of purpose, format, and source. Response time requirements for classes of outputs should be provided.

Indicate proposed file structures and any unusual processing requirements.

5. **Implementation Plan.** The implementation plan should be provided and end products should be identified. A simple milestone bar chart or equivalent should be provided.

6. **Impact and Performance Measures.** Performance measures are defined as those which show whether the proposed program is being carried out as planned. For example, is CBT (proposed system) fully implemented on schedule? Impact measures are defined as those which show whether the proposed program is having the desired effect. For example, did student mastery levels improve 10% in the (proposed) CBT system? Is it alleviating the problem? Describe both types of measures for the proposed program.

7. **Resources.** Provide an overview of the resources (personnel, money, equipment, etc.) needed to implement and operate the proposed program.

8. **Constraints, Risks and Uncertainties.** Identify the factors which may impede the success of the proposed program. Factors beyond the control of your organization would be discussed here.

9. **Systems Life.** State the expected systems life time of the proposed program. A minimum of six years should be provided.

Analysis of Alternatives.

1. **Identify Alternatives.** List and describe alternatives for alleviating the problem. Generally, if there appears to be only one way to solve the problem, the problem has not been adequately defined. See, for example, Figure 3-1 displaying pros and cons of various alternatives for instructional delivery taken from the feasibility study of The Federal Aviation Administation. The alternatives must consider facilities available under the Federal ADP Sharing Program and the use of commercially available services as required by OMB Circular A-76.

2. **Analyze Alternatives.** Estimate the cost for each alternative, time to implement and the estimated impact on the problem. Discuss the advantages and disadvantages of each alternative and explain why the proposed program was selected.

Figure 3-1. ANALYSIS OF ALTERNATIVES

Evaluating Options - The Pros

	STATUS QUO	MANUAL INDIV.	CENTRAL LOCATION CMI ONLY	CENTRALIZED LOCATION CAI/CMI	REMOTED CAI/CMI
Avoids Consequences of Change	X				
Cut Student's Time and Related Costs		X	X	X	X
Builds on Student's Background/ Training		X	X	X	X
Easy Course Maintenance & Security			X	X	X
Standardized Instruction			X	X	X
Cuts Instructor Time & Related Costs			X	X	X
High Quality Interactive Instruction				X	X
Capability for Handling Additional Courses				X	X
Students Operationally Available				X	X
Easy to Handle Peak Student Loads					X
Efficient Evaluation by Field					X
Maximum Travel/Per Diem Savings					X
May Support Proficiency/Field Generated Training					X

Evaluating Options - The Cons

No Room for Additional Courses	X				
FY 1980 Constraints Causing Cancellations	X				
Student Scheduling More Complex		X	X	X	X
Providing for Student Interaction Difficult		X	X	X	X
Course Development More Demanding		X	X	X	X
Substantial Coversion Costs		X	X	X	X
Large Investment in ADP Equipment/ Training			X	X	X
Need for CAI/CMI Authors				X	X
Management of Multiple Learning Centers					X

Beck, John A. and Beardsley, Patricia S., "How Computer Based Training was Cost-Justified in the Federal Aviation Administration." ADCIS, Proceedings, 1980, pp. 98-14.

Detailed Resource Requirements. Indicate the equipment, software, personnel, and other costs required to achieve the proposed objectives. Costs are to be provided for the current system (if any), the development period and the proposed system operation. Costs should be calculated in the same fashion as if an OMB required-A-76 study was being prepared for each year of the proposed systems life.

1. **Present Systems Costs** (if applicable).
   (a) Personnel
   (b) Equipment
   (c) Site
   (d) Communications
   (e) Other, including supplies
2. **Development Costs.**
   (a) Personnel
   (b) Equipment
   (c) Site
   (d) Communications
   (e) Other, including supplies
3. **Operations Costs.**
   (a) Personnel
   (b) Equipment
   (c) Site
   (d) Communications
   (e) Other, including supplies

Milestones. The implementation plan should be subdivided into specific or logical segments. Target dates should be assigned. A milestone bar chart is usually adequate. For very complex systems, a PERT-type schedule showing tasks, duration of each task, starting time for each task relative to the beginning of the project, interrelationships between items and sub-items, etc., would be more appropriate.

External Impact. Implications for other divisions, organizations and/or agencies should be included here.

Deliverables/End Products. Deliverables and/or end products should be identified. Reports, software packages, and equipment are examples of deliverables and end products. Indicate whether the Government or a vendor will own the deliverables when the work is completed.

Telecommunications Study

If the proposed system is to include telecommunications, the cost of required telecommunications support must be estimated. This may be included as part of the Feasibility Study or accomplished in a separate, but related, document. In order to estimate these costs, telecommunications workload measures should be specified and projected over the system life. Alternative telecommunication configurations should be sized to support estimated workload and the least cost alternative should be identified. Agency telecommunications coordinators are a good source of expertise for this type of study. Telephone company systems engineers may also be used when in-house resources are unavailable.

Quantify and Geographically Distribute the Workload. As a first step, the communications traffic must be quantified by geographical location. In order to achieve this distribution, a list of terminal locations is necessary and the types and quantities of each terminal and supporting communications at these locations should be specified. You may encounter many new terms which you will have to ask your communications consultant to explain. For example, listed below are some of the types of terminal or communication functions that should be considered:

(1) Remote Batch
(2) Interactive/Conversational
(3) Transaction Processing
(4) Graphics
(5) Message Switching
(6) Bulk Data Transfer
(7) Line Concentration

Estimate Workload by Terminal Location. If possible, within the constraints imposed by the quality of the data, the base year workload should be estimated by terminal location, quantified in terms of the number of transactions originated at each site by month. Once monthly transactions volume is known, character transmission volume can be specified by site.

Additionally, terminal occupancy time should be specified for terminals at each site. This data, combined with character transmission volumes, will enable the analyst to calculate line occupancy times and to configure communications networks accordingly.

Workload projections should be completed for each existing and proposed terminal location. (However, if the expected number of such sites is large, or if a significant number of terminals are clustered in a given area, it may be necessary to aggregate site workloads for volume projection on a basis which appears reasonable to the user). Upon completion of these analyses, both terminal and line occupancy projections will have been identified. These forecasts will then permit generation of alternative network configurations for detailed cost analysis.

Network Alternatives. Examples of the types of service used in alternative network configurations include:

(1) Dedicated (leased) line service from common carriers (either analog or digital)
(2) Specialized carrier service such as Value Added Networks (VAN)
(3) Dial/FTS/WATS network service

The first of these alternatives represents a network limited to the users in the procuring agency. Multi-drop lines and concentrators could be considered for analysis. In the second alternative, the trunking facilities only are supplanted by specialized carrier services (which are not currently commercially available at all locations). The third alternative examines the use of dial facilities; the choices are ordinary dial, the Federal Telecommunications System (FTS), the Switched Digital Service or the Wide Area Telephone Service (WATS). This list of alternatives is not exhaustive; others which appear feasible to the analysis team should be defined and costed.

Cost Elements of the Analysis. Cost elements which would necessarily be included in the analysis include type of service, modems, line terminations, concentrators, mileage (for dedicated circuits), frequency and duration of use (for dial-up circuits). These costs should be aggregated for each year of the system's life cycle. The least cost equipment configuration identified should normally be selected. Additionally, a telecommunications cost must be developed for the commercial processing alternative considered as part of the OMB Circular A-76 analysis, requiring design of a local line configuration to connect ADP terminal sites to the proposed commercial network.

The A-76 Analysis

If the provisions of OMB Circular A-76 are applicable, then an A-76 study must be included. In the A-76 study the cost/benefit characteristics of processing on a commercial service bureau will be compared to those derived for the lowest-cost internal (Government provided) processing alternative. The A-76 analysis must develop a projection of total computer expenditures under both the internal and the commercial processing scenarios. These expenditure forecasts may have to reflect the expected impact of inflation for all cost elements where prices are not fixed contractually.

The alternative with the lowest present value total cost[1] should normally be recommended as the most cost-effective course of action available to the Government. The total cost of the internal processing alternative remains the same as that developed in the economic analysis of the Feasibility Study. Consequently, the purpose of the A-76 is really to estimate the commercial service bureau cost of processing the same workload volumes at the same level of performance described in the workload forecast section of the Feasibility Study. The cost elements considered are identical to those listed in Feasibility Study.

Assumptions When Costing External Service. Costing external service becomes the principal problem encountered in performing the A-76 analysis. In order to accomplish this step of the analysis at least two critical assumptions are generally required:

1. Where no empirical data exists to suggest a better alternative assumption, the analysis is built upon the premise that user demand for computing resources is not altered by variations in the billing algorithm (i.e., changes in the relative prices of resources).

2. The assumption is made explicitly that any processing arrangements which are available to the user at a Government operated computer center will also be made available to the commercial sector. In other words, it is assumed that a job requiring twelve 9 track tape drives will be accorded identical treatment in both the internal and commercial environments. Additionally, no premium rates or scheduling problems would be expected for computing tasks requiring "unusually high" simultaneous device allocations.

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[1]The procedures in your organization may or may not require that you consider the impact of inflation and/or present value.

Both of these related assumptions involve significant abstractions from reality. However, any alternative treatment of these issues would be equally arbitrary.

Deriving Processing Costs. Once the assumptions stated in the previous sub-paragraph are made, the processing costs can be estimated by applying the following methodology:

1. First, the workload estimate derived in the Feasibility or System Study must be converted into the units used by one or more "representative" commercial service bureau(s).

2. Having quantified the workload in terms compatible with a representative commercial service billing unit, the workload estimates may be multiplied by the service bureau rates to obtain the cost of processing externally. Assuming the representative service bureau is a participant in the GSA Time Sharing Services, GSA should be consulted to determine the currently prevailing discount rate to be applied to these prices.

3. Include shut down costs of any existent systems which would be replaced by the commercial service bureau.

Primary Processing Costs. In order to estimate the processing costs, at least four major cost categories should be considered:

(1) CPU time charges
(2) Terminal connect time charges
(3) Mass storage charges
    (a) shared packs
    (b) private packs
(4) Magnetic tape utilization costs

Deferred and priority processing requirements may be estimated if supporting data can be secured at a reasonable cost. Generally, the assumption can be made that deferred discounts and priority premiums will cancel each other out over the system life cycle.

Recommendation. The least cost alternative should be recommended as the most cost effective to the Government, given the implicit assumption underlying the analysis that both alternatives will be equally beneficial.

Systems Study

For large procurements, after the Feasibility Study has been approved, a detailed Systems Study should be prepared which will refine, and in some cases redevelop, the gross estimates provided in the Feasibility Study. The results of this study should present management with a concise summary of the following elements:

--**The proposed system.** Recommendations for additional resources should clearly present the best estimate of equipment software, telecommunication, maintenance, or other resources needed to fulfill the ADP need.
--**Input/Output.** Data which will be input to the system should be clearly identified as to purpose, magnitude, form and geographical location. Outputs should be similarly summarized.
--**Benefits.** Itemized improvements or savings from the proposed acquisition should be stated in measurable terms.
--**Costs.** All expenses resulting from the development, installation, and continued operation of the proposed system should be itemized.
--**Alternatives.** All alternatives that have been examined should be discussed in terms of why each was less satisfactory than the proposed system.
--**Operational Impact.** The impact of the proposed system on the present system, including personnel, procedures, software, current equipment, and privacy, should be presented.

The information enables management to make an informed decision to recommend the acquisition of all, part, or none of the computer resources, that would be necessary to most effectually implement the computer-based training requirements identified. Studies of data processing needs should provide managers an opportunity to consider new and varied methods of data processing and to identify a data processing approach best suited to the organization's training needs. Training requirements should be specified in a way that clearly differentiates them from conventional data processing. For example, the human factors requirements of the system need to be defined so that it will not be assumed that "any" terminal is an effective learning device for a non-computer specialist or that training staff can use any standard programming language to implement computer-based training programs.

4. GETTING APPROVAL

General

Establishing a computer-based training system can be an exciting process but it can also be frustrating, intricate, and maddening. Computers are new to the training environment and are often consciously or unconsciously perceived as threatening to the positions of others or as dehumanizing mechanical monsters that defy all understanding; monsters are incapable of improving the learning process.

If they are to avoid substantial organizational resistance, CBT program managers and developers must strive to explain their projects very simply. Complex explanations can breed confused questions in unproductive cycles.

Simplicity

Based on the personal and unscientific (but, we think, accurate) observations of several IGCBT members, we have concluded that persons involved in establishing new CBT systems frequently have a hard time succinctly explaining what they're about. Because they often unwittingly find themselves in an advocacy or change-agent role, CBT practioners, when given the choice, sometimes prefer to give a long-winded rather than a short-winded answer to the questions: What is CBT? (The authors freely admit that they, too, share this proclivity.) Unfortunately, this tendency can cause major trouble as the practioners try to overcome the intrinsic organizational resistance to CBT. This resistance arises from the fact that CBT is a significant departure from conventional training techniques.

Hanging K.I.S.S. (Keep It Simple, Stupid) signs around the office doesn't help. In this chapter we hope to suggest some more effective solutions to the "explaining" problem.

What's the Requirement?

No amount of extolling the virtues of CBT really clarifies anything if the basic training requirement is not understood. Without a training requirement, there is no need for CBT. The audience at an organization's internal presentations on CBT may not be very knowledgeable about its training requirements. Focusing on the actual training requirements of your organization is one of the

keys to keeping listeners' minds off of the relatively unimportant details of how CBT operates. CBT cannot be explained simply and clearly if it's the only concept receiving attention.

This approach of talking about CBT by presenting it within its greater training context may seem obvious, but we've found few CBT practioners who do it. Presenters may wrongly assume their audience understands the training context, they may not understand the importance of presenting a CBT program as a response to a definitive training need.

Overall Logic

The following format is one we recommend for internal presentations on CBT to decision makers. Formal presentations should be short, e.g., no more than 10-15 charts. Keep back-up charts in reserve to deal with questions but don't volunteer them.

1. Requirement
   What is the overall mission which training must support? (The answer should be obvious to everyone at the presentation which makes it a good place to start.) What knowledges and skills must the workforce learn? What number of students are expected in the next few years due to retirements, turnover, hiring for new programs, etc.? Would it be beneficial to reduce the current travel or instructor reqirements? How well is the current training system doing or expected to do in supporting the overall mission? Is there already a problem in training due to a shortage of resources? Don't start with an explanation of how CBT "works" or how any other training works.

2. Potential Adverse Impact
   What will happen if you don't do something about the problem? This question must be answered in terms of the organization's mission. It may be difficult or impossible to prove a direct link between training and workforce performance because of other factors such as the typical unavailability of reliable evaluation data related to conventional training. In that case a concensus subjective judgement may be offered.[5]

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[5]See Johns Manville. This excellent empirical study may be useful as back-up information. It shows that structured training is less expensive than unstructured (or "buddy system") training and that students trained in a structured manner solve on-the-job problems much more efficiently.

3. Ways to Meet the Requirement
Discuss the various ways of delivering the required training, including CBT. Show in overview fashion how the use of CBT would change the current training system. Don't neglect to mention the ways in which computer management of training can provide instant evaluation information for managers. Only then define CBT in a very summary fashion, e.g., show a picture. Save any further explanations for demonstrations (see below). CBT is now used by so many organizations that for reasonbly informed managers its validity as an effective training medium should not be in question. Because of its potential to distract from the objective of the presentation, don't offer to discuss validity in a group presentation, unless someone really wants to know. In any case, a pilot project with the purpose of proving that CBT "works" is clearly not justified (unless the application is highly unusual).

4. Cost Effectiveness
This is a standard requirement for a staff presentation. In one chart show the estimated costs of alternative ways to meet the training requirements. Your alternatives will depend largely on the ways your organization currently delivers training, but you may wish to introduce the cost/benefit of other technologies in addition to or apart from CBT. Your analysis might also include the cost benefit of centralized versus decentralized training. Another chart should summarize the many nonquantifiable pros and cons of CBT. In some cases these considerations may be a more important consideration than cost savings. (Figure 3-1 is an example of this kind of chart.)

5. Implementation
Show overall timeframe. The details of how the developers will do their work should be kept as back-up information. Show summary budget data.

6. Recommendation
Summarize the decision(s) you want. (Remember to smile.)

Feeling for CBT

So much for logical "left brain" concerns. Don't forget your audience's intuitive or "right brain" side. It is necessary to provide demonstrations of CBT to key decision makers. In each demonstration the decision maker should have time to sit one-on-one with a terminal and view courseware at least somewhat related to his or her organization, gaining some hands-on experience that is similar to that of a "typical" student. Carefully planned, this activity does more to overcome conscious or unconscious computer resistance/fears than anything else.

If many decision makers (we're referring to key staff as well as management) are involved, as they generally are with CBT, this demonstration process can take a lot of time. However, it is definitely worthwhile. We doubt that a controversial CBT proposal can be accepted in any organization without a thorough demonstration process.

Each demonstration should be analyzed and constructed as thoughtfully as your best training course except that the "training outcomes" should be stated in "right brain" terms. What experience, impression, pictures, feelings, etc., do you want transmitted? E.g., does each person receiving the demonstration know what it feels like to take a stimulating CAI lesson? (They don't necessarily have to take the whole lesson to get that feel.)

Conclusion

Starting or growing a CBT program is a complex undertaking involving many organizational adjustments. It should be remembered that resistance to new, complex technology is frequently encountered. Analyze your strategies for introducing the CBT technology carefully. Know your audience. What "works" in one situation may not work in another. Some people respond more to hands-on experience while others require additional discussions or presentation. In any case, the difficulties of the undertaking may be reduced if the staff responsible for the program continually strive to keep their explanations of what they are doing as clear and simple as possible by emphasizing the greater context in which they are working.

5. SYSTEM PLANS/PROPOSALS

The feasibility study described in Chapter 3 will probably require an overview implementation plan to be developed for each serious alternative; however, once the feasibility study is formally approved, much more in-depth implementation planning will be required. Automated data processing (ADP) procurement rules require studies of a number of considerations and issues. Some organizations may require these studies to be wrapped up in a single document known as a "system proposal" before they begin the procurement process. Others may link the studies more directly with preparation and approval of a request for proposal (RFP).

The IGCBT recommends starting out with "small" prototype projects (see Chapter 6) and building the CBT system through a series of discrete evolutionary steps. Unfortunately this approach and other aspects of good CBT system development may be at odds with the approaches used standardly by the segments of the organization which normally control the procurement of ADP equipment. Many organizations with CBT programs (both Government and private) have experienced (or continue to experience) difficult internal conflicts between "CBT'ers" and "ADP'ers".

The best way around the conflict seems to be to do "what everybody wants." In other words, make sure you get approval in the feasibility study to launch at once into limited prototype projects (i.e., what the trainers want) at the same time the overall system proposal (or plan) is being studied and prepared (i.e., what the computer specialists want). Lease as much equipment as possible for the prototype projects to avoid a premature commitment to ADP equipment. Under this approach, you can get the program moving through the prototype project and start the arduous process of breaking down organizational resistance (see the importance of demonstrations discussed in Chapter 4). If the prototype effort and the overall system planning process occur simultaneously, the two efforts can complement each other.

This chapter offers suggestions for designing an overall system proposal which responds to the various requirement of the ADP procurement process:

System Requirement

After summarizing the background of your project, your system proposal (or RFP package) will need to describe the system you desire in terms of input/output and hardware/software.

Don't be thrown by those terms. Basically a CBT system is a hardware/software package which is capable of supporting the development and delivery of training courses or course components. Some IGCBT members make a distinction between software and courseware and between computer programmers and CBT authors. Specify the functional, not the technical, characteristics of the authoring system you want your authors to use. The authoring system should be off-the-shelf; it's very expensive to invent your own or even modify an existing one.

Input/output as it applies to CBT must be defined in terms of courses and students; courses being the input and trained students being the output. This kind of technical computing terminology and logic is so strained and artificial as to be of little value. Avoid it by describing what you want the system to do in functional terms (i.e., good old "trainingese"). Your original training requirement analysis should be a considerable help.

System Flow

A conventional computer system proposal usually contains elaborate flow diagrams detailing the flow of all data elements in the system. That's not a practical approach for CBT applications, particularly if you're specifying an off-the-shelf authoring system. However, we suggest you chart the intended CBT course development and administration process. The results of that exercise will be useful in preparing the new policies, procedures, and orientation packages you will need for your CBT system.

System Impact

You will need to identify any other computing or telecommunication systems in your organization that the CBT system will interact with, and that's really all a conventional proposal is interested in. The major impact of a CBT system, however, is on the traditions, limits, career ladders, administration, etc., of your overall organizaion. It is advisable to prepare for the likely organizational changes by summarizing them up front.

Privacy Act

You will need to consult with your organization's Privacy Act coordinator to see how your organization interprets the Privacy Act. The simplest position is the blanket statement that all records maintained in the CBT system are covered under the OPM/Government-1 General Personnel Records System.

Request for Proposal (RFP)

Whether you launch into preparing RFP's as soon as your feasibility study is approved or go through the intermediate step of preparing a system proposal, you will eventually have to define your CBT system requirements to vendors through some procurement process. You can in fact use less time consuming procurement processes than RFP's--such as a two-step invitation for bid (IFB) if you are quite sure about your exact requirements. In either case it will involve language and concepts from the computer world. Figure 5-1 shows the format of a typical RFP.

Figure 5-1. Typical RFP Format

RFP TABLE OF CONTENTS

A. Cover Sheet, Standard Form 33
B. Representations, Certifications, and Acknowledgements
C. 1. Solicitation Instructions and Conditions
   2. Format Instructions
D. Glossary
E. Special Provisions
F. Mandatory Requirements
G. Mandatory Support Requirements
H. Desirable Features (optional)
I. Cost Information (Unit Price Tables)
J. Supplemental Provisions
K. General Provisions, Standard Form 32, as amended, and Additional General Provisions

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NOTES TO FIGURE

Sections D, E, F, G, and H will be completed primarily by the user. The other sections are primarily "boiler plate" articles of information that contracting offices will supply, with minor adjustments made for the user.

Section B. Representations, Certifications, and Acknowledgements. Contains forms that identify minority or small businesses, types of business, eligiblity of product, etc.

Section C.1. Solicitation Instructions and Conditions. Contains instructions to offerors concerning submission of bids and proposals; inspection of site(s) where services are to be performed, restrictions on disclosure, award of the contract, and forms for disclosure statement.

Section C.2. Format Instructions. Contains guidelines for preparing the proposal and a description of the contract structure.

Section D. Glossary. Prepared by user, ADP, and contracting people.

Section E. Special Provisions. Contains primarily contractual information on type of contract, terms of contract, how to handle replacement of equipment or repairs, standards for performance and evaluation criteria.

User will be concerned primarily with systems life of contract and the specific evaluation criteria used to judge the proposals. A question that is frequently asked is "how is it possible to determine whether any particular vendor's hardware and software can do the job?" "Benchmarks!" Government procurement officers will be happy to set up a benchmark evaluation system of the proposals. Each of the vendors submitting a proposal must demonstrate a system which can do the things specified in your RFP. If they can't, they are disqualified. This evaluation scheme is more expensive for both your organization and the vendor, but in large procurements, it is a small investment to insure a successful system.

Section F. Mandatory Requirements. Sections include general system requirements, hardware requirements, software and authorizing language requirements (both for system and for specific applications). User will be very involved in the development of this section. Describe functionally what it is that the system must accomplish (e.g., the system will interactively deliver lessons to students at any terminal in the system simulataneously.) Be specific. Describe how the system will work for each of its users: students, instructors, authors and managers. Describe what reports are required and what they should look like. Describe the environment in which the system will be used. Describe essential requirements to vendors as clearly and concisely as possible. Let the vendors respond in terms of what hardware, software and authoring languages they will provide to meet your requirements.

Section G. Mandatory Support Requirements. Will contain information on installation sites and delivery requirements, site planning (space, electrical, mechanical, communication), hardware and software maintenance, training requirements, and manuals and publications.

User involved here, especially on installation and site planning issues.

Section H. Desirable Features. In this section any features that you would like the system to eventually have would be listed. For example, complex graphics vs. business graphics.

Section I. Cost Information (Unit Price Tables). Contains tables for costing hardware, software, support services, and government in-house costs. Instructions for determining costs and questionnaires are included.

Section J. Supplemental Provisions. Contains provisions regarding contractor commitments, warranties, and representations, risks of loss or damage, patent and copyright indemnities, and privacy act violations. (These supplement general provisions in Section K, following).

Section K. General Provisions. Contains provisions on making changes, payment for extras, variation in quantity, inspection, making payments, assignment of claims, default, examination of records, disputes, patent and copyright infringement, overtime compensations, etc.

Small Systems

For those acquiring small systems or systems with limited applications, it may be advisable to consider researching the market, then specifying the most suitable hardware, software, and authoring language in an IFB. However, be warned, "computer people" are almost as bad, if not worse, than "training people" in using jargon and acronyms to describe their systems and capabilities. Learning enough to be able to talk "computerese" and to fathom the distinctions in the hardware and software capabilities takes considerable time and energy. For this reason, most organizations have found it essential to have a knowledgeable computer systems consultant or analyst as a member of the CBT development team even for small projects.

6. PROTOTYPE SYSTEM DEVELOPMENT

Why a Prototype Project?

CBT must be built over time. The process of winning user support, developing the many new administrative procedures required, training course developers, and converting or developing courseware is a large task which cannot be accomplished all at once. Furthermore, changes in initial plans and minor mistakes in implementation are inevitable. Starting "small" allows the program manager to make corrections with a minimum of fuss or impact. In some circumstances it is possible to run protytpe projects simultaneously with planning for a large system, i.e., in advance of approval of a major system proposal, with the activities in each effort inter-relating.

Project Control

Even a "small" prototype project is a complicated undertaking. Systematic planning can mean the difference between a rewarding and acclaimed success which can result in an important building block for the evolving CBT system--or an embarassing failure. Figure 6-1 lists a number of elements which should be addressed in a project plan. This list is not exhaustive, but should give you a start in planning for project control.

Level of Effort

Once everyone is committed to obtaining and trying out a new system, materials must be developed, people trained, space prepared, equipment ordered, and on and on. . . The complexity of the project depends largely on the size of the course and the number of locations at which it will be tested. If an entire training course is to be redesigned to properly integrate the CAI or CMI material, then the tasks may be very time consuming.

It is very difficult to give standard estimates of the time which will be required since so much depends on the CBT authoring language, the nature of the material, and the experience of the designers. The following time estimates have a wide variance and are at best only general indicators of the amount of effort that could be involved.

Figure 6-1. Elements of Project Control

People: Organizational Analysis
Job Analysis
Position Descriptions
Performance Standards
Evaluation Procedures
Award Procedures
Performance Reporting Procedures
Resource Allocation Procedures
Motivation
Training of developers and training center administrators
Student orientation
Administrative procedures for training deliery

Work: Planning Cycle

Estimating Techniques
Projection Techniques

Administrative Control Element (Project Control Office)

Development Schedules
Release Schedules
system Effectiveness Reviews

Review Committees (Developer and User)

Commitment Compliance
Design Compliance

Project Tracking System

Resource Allocation Procedures

Money: Budget Plan

Budget Monitoring System

Budget Reporting System

The design of tutorial CAI lessons requires about 200 hours of preparation per hour of instruction for new CAI authors and developers, and about 100 hours for experienced developers. It takes about 300 hours of time to develop an hour of simulated material for experienced simulation developers. Simulation design requires additional author expertise. If a computer based training program consists of computer managed instruction (tests, etc.) alone without much interactive instruction delivered directly via a computer terminal, then the development time for tutorial instruction required is shortened considerably. It would take an estimated 50 hours of preparatory time per hour of computer managed instruction (CMI) delivered. In this instance, a student may, for example, take a test on the computer terminal and based on the results of the test be referred to view a video tape and/or read a self-instruction manual and return to take another test. Although this form of instruction makes the least effective use of the flexibility of the computer as a learning resource, it does promote the use of individualized instruction, a necessary first step. In addition, more trainees can be accomodated if the training resources (computer time and course development time) are in short supply. Because of resource constraints, CMI may be the only way an organization can initially justify entry into the CBT mode of individualized instructional delivery.

Example

Figure 6-2 is an example of a prototype development schedule. The sample project schedule reflects the complexity of such projects. Designing and implementing the computer system is just one of the major tasks. Without high quality computer courseware and other training materials, well-trained people to operate the system, and well-equipped space, the computer system simply will not provide the intended results.

Figure 6-2. Example of a Prototype Project Development Schedule

REVENUE AGENT
MARCH 1, 1982

COMPUTER-BASED TRAINING PROTOTYPE SCHEDULE

1 OF 3

	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE
COMPUTER SYSTEM	RFP finalized. RFP approved by D.S./ADP Policy Board; forwarded to RM:FM:C with funding certificate and A/C Data services priority number.	CBD Announcement of RFP. RFP issued. BEGIN SITE PREP AT NTC	Complete evaluation checklist. Plan test procedure. Get CDC tapes of existing data. Seek funding certification for 3.6 million	Receive proposals. PROPOSAL EVALUATION	Technical Evaluation to Contracting. RFP(II) complete. CBD Announcement cancelling RFP(I). RFP(II) approved by D:C:H:E and forwarded to PM:HR:C. WRITE, TYPE AND REVISE FEASIBILITY STUDY — CONSULTATION WITH D:C:H:E AND PM:S:FM	Contracting Review — RFP(II). CBD announcement of RFP(II). RFP issued (45 days)
SOUTHEAST REGION	Establish N.O. Funding System	Identify POD lay-outs and equipment needs.	Develop instructor profile	Begin site prep at POD's		PREPARE INSTRUCTOR TRAINING
S-I MATERIALS	COMPLETE ALL MATERIALS: EDUCATION, CONTENT AND EDITORIAL REVIEWS; TYPING, PROOFING, FINAL REVIEW. PREPARE EXHIBITS			DEVELOPMENTAL TRY-OUT	Analyze data. REVISE MATERIALS — TYPING	
TESTS AND PRACTICE	Update, revise existing test items. Prep for task force. PREPARE TRAINING & SPECS FOR DRILL & PRACTICE	TASK FORCE (ALL DRILL & PRACTICE). EDUCATION, CONTENT & EDITORIAL REVIEWS; TYPING, PROOFING, FINAL.		DEVELOPMENTAL TRY-OUT	Analyze data. REVISE MATERIALS	MATERIALS TYPED ON TAPE
SIMULATIONS/ CASE STUDIES	TASK FORCE (SIMULATIONS)	EDUCATION, CONTENT & EDITORIAL REVIEWS; TYPING, PROOFING, FINAL REVIEWS.	Prepare Exhibits. Prepare Instructor Guides	DEVELOPMENTAL TRY-OUT	Analyze data. REVISE MATERIALS — TYPING. Prepare "classroom" instructor guides	
A-V MATERIALS	Write simulation video scripts. Design slide/tape storyboards	Videotape Production for simulation scripts. Write overview video script	Video production for simulation script. Finalize slide/tape storyboards	DEVELOPMENTAL TRY-OUT	Analyze data. REVISE MATERIALS — TYPING	Videotape production (Ongoing)
CLASSROOM MATERIALS	REVISE LESSONS AND EXHIBITS. REVIEW CYCLE BY TAX LAW A BEGINS			MATERIALS TO ROCAPPI. ROCAPPI EDIT CYCLES		Deliver final exhibits to Tax Law A
ADMIN. GUIDE			GATHER INFORMATION (Requirements, estimates, research, etc.)	Develop management system, optional activities, ITI techniques, use of facilities, resources with SER.	Finalize course map, module descriptions, estimated times, instructor guides	Write draft of guide.
EVALUATION	Establish model, objectives, action plan, controls, sample, etc.		Prepare Level 1 Material for try-out	DEVELOPMENTAL TRY-OUT. IDENTIFY RAI CLASS OFFERINGS FOR LEVEL 2	Prepare Level 2 Materials	

REVENUE AGENT
MARCH 1, 1982

COMPUTER-BASED TRAINING PROTOTYPE SCHEDULE

	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
COMPUTER SYSTEM	Feasibility Study to D:C:H:E for approval	Receive proposals D:C:H:E approval of feasibility study PROPOSAL EVALUATION PM:HR:C — Cost; PM:HR:T:S and D:C:H:E — performance Submit F.S. to Treasury for approvals & request delegation of procurement authority	Plan acceptance test procedures and staffing Contract Negotiation (Contracting) Request telecommunications	Meetings with contractor and site inspection Prepare final test designs for all aspects of system Contract Award Install telecommunications Final site prep — all sites	Contractor-conducted training (Orientation) 4 sessions Equipment installed SYSTEMS ACCEPTANCE TESTING — ALL SITES Begin inputting data and debugging	Contractor-conducted training (Users) 4 sessions
SOUTHEAST REGION	Plan for obtaining "trainee" for management try-out PREPARE INSTRUCTOR TRAINING		Select instructors from SQ list	Site coordinator duties assigned Conduct SIT (specialized for prototype) for instructors Prepare instructor training (computer portion) Identify personnel for Atlanta try-out	Confirm trainees available in Jan. Prep for instructor training Prepare Orientation for SER RLI trained as instructor at N.O. Atlanta POD try-out of management system Conduct SER Orientation RLI debriefed at N.O.	Revise system and instructor training Prepare instructor evaluation criteria
S-I MATERIALS	TECHNICAL AND FUNCTIONAL REVIEWS FINAL CONTENT AND EDUCATION REVIEWS	ROCAPPI EDIT CYCLES	PRINT CYCLES — QUICK ORDER			Revise Materials
TESTS AND PRACTICE	TECHNICAL AND FUNCTIONAL REVIEWS FINAL CONTENT AND EDUCATION REVIEWS PREPARE COMPREHENSIVE TEST					Revise Materials
SIMULATIONS/ CASE STUDIES	TECHNICAL AND FUNCTIONAL REVIEWS FINAL CONTENT AND EDUCATION REVIEWS	ROCAPPI EDIT CYCLES	PRINT CYCLES — QUICK ORDER			Revise Materials
A-V MATERIALS	TECHNICAL AND FUNCTIONAL REVIEWS SLIDE/TAPE PRODUCTION (VIDEO FORMAT)		DUPLICATE TAPES			
CLASSROOM MATERIALS	RESEQUENCE LESSONS FOR PROTOTYPE PHASES	ROCAPPI EDIT CYCLES				
ADMIN. GUIDE	REVIEWS: EDUCATION, CONTENT, EDITORIAL; SER	Typing—short-order print				Revise Materials
EVALUATION	Revise Level 1 and Level 2 instruments (consult with SER and function)	Typing and short-order print	Identify control groups; contact regions	Implement Level 1 and Level 2 with Control Groups		COLLECT AND ANALYZE DATA

	JANUARY	FEBRUARY	MARCH
COMPUTER SYSTEM	Continue field trials of system	IMPLEMENT RAI (P.O.D. PHASE)/IMPLEMENT RAI (CLASSROOM PHASE)	Analyze Prototype data (P.O.D. phase); Transmit results to Treasury Finalize service-wide RFP; Submit RFP to D:C:H:E
SOUTHEAST REGION	Training of instructors at N.O.; Instructor Prep at POD's	IMPLEMENT RAI (P.O.D. PHASE)/IMPLEMENT RAI (CLASSROOM PHASE) Observe, evaluate prototype Evaluate instructors; Debriefing of instructors (P.O.D. phase)	Observation and evaluation of classroom phase; Debriefing of instructors (Classroom phase)
S-I MATERIALS	ROCAPPI and short-order print	IMPLEMENT RAI (P.O.D. PHASE)/IMPLEMENT RAI (CLASSROOM PHASE)	
TEST AND PRACTICE	Input corrections to materials	IMPLEMENT RAI (P.O.D. PHASE)/IMPLEMENT RAI (CLASSROOM PHASE)	
SIMULATIONS/ CASE STUDIES	ROCAPPI and short-order print	IMPLEMENT RAI (P.O.D. PHASE)/IMPLEMENT RAI (CLASSROOM PHASE)	
A-V MATERIALS		IMPLEMENT RAI (P.O.D. PHASE)/IMPLEMENT RAI (CLASSROOM PHASE)	
CLASSROOM MATERIALS			
ADMIN. GUIDE	Typing and short-order print	IMPLEMENT RAI (P.O.D. PHASE)/IMPLEMENT RAI (CLASSROOM PHASE)	
EVALUATION	Prepare report on control groups	IMPLEMENT RAI (P.O.D. PHASE)/IMPLEMENT RAI (CLASSROOM PHASE) Questionnaires, Observations, Interviews	Analyze data Continue Level 2 on Prototype Classes

7. CBT COURSEWARE DEVELOPMENT

Development Model

Development of computer courseware should occur within a framework for systematically designed individualized instruction. There are many models for developing instruction, no one of which is most appropriate for CBT. Although development models should be adopted or adapted on the basis of how well they fit individual organizations' styles and program needs, we recommend starting from the basic instructional system design (ISD).

Any development model used, however, should attend to the following:

Front-end analysis: Define the learning population, assessing needs, analyzing tasks learners are to perform, identifying objectives and content, sequencing objectives and content, etc. (This work should build on the needs assessment which preceded selection of CBT as the training method, Chapter 2).

Selection of instructional method: Identify a range of possible methods for delivering instruction and selecting methods on the basis of their costs and benefits, using information gathered in the front-end analysis. Methods need not be limited to computers, but can also include other appropriate media.

Design: Pay attention to the various ways instruction can be designed to promote learning. Factors affecting learning such as the provision of practice and feedback should be identified. Figure 7-1 summarizes the main forms of computer-assisted instruction. The forms can be combined or used independently.

Evaluation: Attention should be given to the various methods for trying out and testing the adequacy of the courseware designed. Criteria such as effectiveness, efficiency (time and cost), etc., should be identified.

Development Team

Before a prototype is designed or conducted, the project leader must be assured that all individuals participating in the prototype have the skills and knowledges required to perform their respective roles. CBT development is most successfully handled by a team configuration. The development team should consist of an instructional designer, a programmer and/or systems specialist familiar with interactive programming. Subject matter or content specialists can be detailed to the project for as long as it is required to provide the needed technical information.

Figure 7-1. Categories of Computer Assisted Instruction

Drill and practice. The computer presents the students with exercises/problems that students must perform and solve. These exercises may involve open ended, constructed responses (students compose their own answers) or pre-selected responses (students choose answers from a list provided). Scores can be recorded by the computer. Generally, the design of drill and practice exercises should follow the rules for good test construction.

Tutorials. The computer presents information, prompts students, asks questions about the information presented, requests responses, informs students about the adequacy of responses, and determines each student's progress path or matrix for the course. Tutorials can be deductive or inductive. Deductive tutorials present generalizations/principles first and then require students to make responses involving application of the principles presented. Inductive tutorials begin by requesting responses of presenting examples and illustrations of instances involving applications of principles and then require students to infer generalizations. Usually, tutorials should follow the rules for designing programmed instruction and/or information mapped materials. In order to effectively utilize the computer as a training tool, considerable opportunity MUST be provided for the student to interact with the computer. Progress through a lesson may be determined by student response, or a computer controlled branching.

Simulations. The computer presents simulated job problems or tasks to give the student a training experience that is as real to life as possible in a more controlled manner than is afforded by the usual on-the-job training situation. Since simulation training is structured and is part of a formal training program, it can reduce the cost and time generally required by OJT, though it does require a considerable amount of developmental time. If technical equipment is to be simulated, a high resolution CBT terminal screen is required. (some systems now employ a videodisc generated picture.)

Normally an instructor whose background is primarily technical should NOT be assigned to lead the development team. The project manager must assure the adequacy of staff and equipment resources and coordinate the production of course materials so that the team operates as efficiently as possible. The project manager must also ensure that the development team keeps up to date in the latest CBT design techniques. CBT is a fast changing area and improvements are frequently introduced. Professional CBT organizations can be an important source of such information (see Appendix C).

Present job classification standards make it difficult to recruit persons with the necessary skills. For instance, the GS-235, Employee Development Specialist, or GS-1710, Education Specialist, series are not specific enough to require CBT-related skills. Recruiting in the GS-334, Computer Programmer/ Analyst, series will probably identify persons with automated data processing knowledges but none of the necessary training knowledges. We recommend, therefore, classification of most members of the CBT development team as GS-1701, Instructional Technologist. Although this series requires a bachelors degree it allows considerable flexibility in recruiting. Specific CBT skills can be required, but persons with a wide variety of backgrounds who have acquired those skills can meet the basic qualification requirements.

Quality

Good quality courseware is an essential element in winning user acceptance, particularly in prototype efforts when inexperienced users are likely to be very frustrated by shortcomings rather than having the experience needed to accept them with good humor or a tolerant, helpful attitude. CBT, particularily CAI, requires course developers to think about training in new ways. The "Computerized lectures" which are sometimes typical of new developers' first efforts can be very boring. Because they do not utilize the interactive capability provided by the computer. The back and forth exchange between student and machine is the most dynamic and salient feature of an automated individualized instruction program. Designers cannot afford to short step this process. A continuing program of in-house seminars with skilled team members (or outside consultants) may be necessary to bring the whole development team up to an acceptable level.

Standard course prototyping and validation techniques must be supplemented with one additional step: the one-on-one tryout. The one-on-one tryout

consists of a course developer sitting with a typical student (not another already partially knowledgeable instructor or staff person--short cuts not permitted here!) while s(he) takes the course. The course developer should note everything the student does, including nonverbal behavior and thoroughly discuss with the student any frustrations or negative reactions. Although it means a little extra time and effort, this step may account for the critical difference between acceptance and non-acceptance of the lesson.

8. EVALUATION AND MAINTENANCE

General

Evaluation of training programs is conducted at continuous as well as discrete and specified intervals. Evaluation checkpoints should be constructed within each phase of systematic training program design, development and implementation. The first step to evaluation is careful planning. The CBT manager and/or CBT development team should clearly specify project goals and training outcomes. The inter-service Instructional Systems Design (ISD) model previously cited could be used as a basic source of reference. The reader may also consult another reference by William R. Tracey, Human Resource Development Standards, New York, Amacom, 1981 (See other references in Appendix A).

Next the project manager should assure that minimum standards for the acceptance of each project and program goal and objective are hammered out in advance. These standards, as well as the project goals and/or learning objectives may have to be changed or updated as new information is obtained. Although this process is somewhat time consuming, it will result in the achievement of more qualitative products, and more assurance of optimal staff productivity within prescribed time and cost constraints. This is particularly critical when using expensive computer resources if management and user approval and acceptance is required.[1] Generally resource utilization is a critical issue in the implementation of new CBT systems. Once the benchmarks are determined, time tables for assessing outcomes must be prescribed. Methods for the collection and analysis of evaluation information should be determined in advance as these will affect the project's overall cost and resource requirements.

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[1]The authors recognize that there is a considerable gap in published standards specifically directed to the construction or evaluation of computer-based training materials. The IGCBT has elected to address this problem as its first priority for 1983. The availability of languages and courseware is another separate but related concern.

Ongoing Project Evaluation Components

--Regular review of staff progress and accomplishments; check against project program goals and standards.

--Problem definition (where applicable); recognition of actual or potential deficiency or inadequacy.

--Collection of information to specify problem dimensions and potential solutions.

--Evaluation of information.

--Specification of the pros and cons of potential solutions.

--Evaluation against general performance criteria or standards for program success.

--Development of plan to improve the problem.

--Establishment of priorities/time chart

--Determination of resources required.

--Systematic follow up for solution and documentation progress.

--Instiution of new or additional means of quality control (if indicated).

The above processes may (and do) take place informally via regular "problem solving" thought processes or discussions. However, for more complex or sensitive problems, it is strongly recommended that the CBT manager outline and follow all of the steps, obtain management concurrance and document the results.

Figure 1-1 in the introduction showed the major steps required to implement a computer-based training program. It can be seen that overall project implementation and evaluation are closely tied to both the design and implementation of the prototype phase(s) of the CBT program. Careful documentation and evaluation of the prototype can provide the basis for one of your most useful and successful justifications for full system implementation. Costs for each aspect of the program should be documented as this may provide some excellent information for future budget estimations.

Training Portion of Evaluation

This portion of the evaluation typically consists of what some define as internal and external phases. Others may define these phases as formative and summative. Internal, as we shall define it here, consists of the evaluation of the results achieved by the student after completing a computer based training program. This should, whenever possible, be contrasted to achievement of students with similar backgrounds, in comparable programs, using other means of training delivery (e.g., classroom, individualized (non-automated) and CBT.) Achievement can be measured by classroom performance (tests) and/or by the student's ability to successfully perform required hands on applications, to solve case problems or to succeed at follow-on training for which the CBT training is a prerequisite.

External evaluation, as we shall define it is the phase of evaluation which concerns the measurement of a student's progress in on-the-job tasks that closely parallel the training tasks that were completed. This later phase is not often accomplished in any training program because of the demand on limited resources that it requires. However, one model for the collection of information for external evaluation is soon to be implemented and released by the Internal Revenue Service. This model tests retention of the students three to six months following formal training to determine how much information has been retained and used on the job. Information will also be collected (interview data and supervisory approvals) from students and supervisors in terms of on-the-job performance.

Currently more training managers are attempting to more systematically evaluate training effectiveness and its relation to on-the-job performance. It should be noted here that valid systematic training evaluation is an extremely costly (though critical) process, particularly where there are large and/or widely dispersed populations. This is why though evaluation is always included as a part of the systematic process of training design and development, it is seldom implemented in a very valid or effective manner.

However, the potential offered by the computer to conduct, analyze, and validate tests and other training information instantly makes the process infinitely more affordable. Considerable benefits could result from substantial increases in training effectiveness. It is recommended here that the reader review two additional references relating to cost effectiveness of training:

Greg Kearsley, Cost, Benefits, and Productivity in Training Systems, Addison Wesley Publishing Co., Massachusetts, 1982 and Jesse Orlansky and Joseph String, Cost Effectiveness of Computer-Based Instruction in Military Training, IDA paper, p-1375, Institute for Defense Analysis Alexandria, VA, April, 1979.

Terminals at dispersed field sites or work sites could be used to collect on-the-job performance information, to test the readiness of employees to perform increasingly complex aspects of the job, to assess ongoing training needs and to assure a closer relatioship of training to job task proficiency. When carefully and systematically designed, training deliverd by computer can provide one built-in means of evaluation and quality assurance of the training program.

9. CONCLUSION

In the starter kit the IGCBT members have attempted to address the most critical aspects of initiating and managing a successful computer-based training program. We have given each of these elements (depicted in Figure 1-1) a considerable amount of thought, and we hope that they will provide some assistance to the training professional, particularly as s(he) is first beginning in the relatively new field of computer-based training. It is our firm belief that training professionals or instructional technologists who are very knowledgeable about the instructional design process should have the lead management responsibility in the design, implementation, and evaluation of computer-based training systems. Although subject matter experts and data processing personnel are very important members of the CBT design team, the training results that are required are best assured when each step of the process is designed and evaluated in a context of student needs and ultimate training outcomes.

The remainder of the conclusion of this Starter Kit is to be provided by you, the user or reader. Please provide your comments back to us as soon as possible so that we may include them in our next revision. (We've provided a general comments sheet in the front of this document.) Do indicate, as specifically as possible, your role in the design, implementation and/or evaluation of the CBT system, whether you are employed in the private or public sector, and the size and configuration of your training population as well as the system you plan to configure. No information will be printed about the information you provide without your express written consent. We are equally interested in general trends.

One area that the group would particularly like more information is the area of CAI standards. We have not been able to find a good overall set of CAI product (or lesson) standards or a CBT system standard requirements package. These would be of use to us to train new CBT development staff members to set up courseware development contract specifications, to evaluate existing CBT courseware, to design CBT systems, etc. This is an area that the IGCBT has decided to concentrate on over the coming yesr. Any suggestions, recommendations, or actual standards which you have used would be greatly appreciated.

Finally, if you would be willing to provide assistance to other CBT managers, in either a formal or informal sense, please let us know.

APPENDIX A

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70 Main Street, Peterborough, NH 03458

Classroom Computer News
P.O. Box 266, Cambridge, MA 02138

Creative Computing
Box 783- ., Morristown, NJ 07960

Computing Teacher
Eastern Oregon State College, La Grande, OR 97850

DATA TRAINING
Warren/Weingalten, Inc.
176 Federal St, Boston, MA 02110

INFOWORLD (Newspaper)
530 Lytton Avenue, Palo Alto, CA 94301

Interface Age
P.O. Box 1234, Cerritos, CA 90701

Kilobaud
1001001, Inc., 80 Pine Street, Peterborough, NH 03458

Kilobaud Microcomputing
1001001, Inc., 80 Pine Street, Peterborough, NH 03458

Personal Computing
1050 Commonwealth Avenue, Boston, MA 02215

Recreational Computing
Department K5, Box E, Menlo Park, CA 94025

Soft Side
The Software Exchange, Inc., 6 South Street, Milford, NH 03055

THE
Technological Horizons in Education (free to principals)
7 Spruce Street, Action, MA 01720

80 Microcomputing
80 Microcomputing, Subscription Department
P.O. Box 981, Farmingdale, NY 11737

APPENDIX B

GLOSSARY

ACCESS TIME	The period of time between calling for information from memory and the delivery of that information. A disk storage is generally faster than tape storage.
ADDRESS	Designates where information is stored within a memory device.
ALPHANUMERIC	The computer symbols, letters (A-Z) and/or numerals (0-9), and/or special punctuation, mathematical, or graphic symbols.
APPLICATION SOFTWARE	The software required to perform the user applications described in the functional requirements section.
ARCHITECTURE	The internal, preset arrangement or organization of a computer that determines how the computer operates.
ASCII	American Standard Code for Information Interchange. A Binary number code for letters, numbers, symbols, etc., accepted as a standard by the industry.
ASSEMBLER	The program that converts English in machine language (binary format).
AUTHORING LANGUAGE	Programming language with codes specifically designed to handle major courseware needs such as response judging.
AUTHORING SYSTEM	Prepackaged software designed to help authors create courseware without elaborate programming.
AUTHORS	Writers who use the CBT language processor to create computer courseware, for either CMI or CAI applications.
BASIC	Acronym for Beginners All-Purpose Symbolic Instruction Code. Using common English words and mathematical symbols to perform arithmetic and logical operations in the computer to solve problems.
BAUD	Date with which one device transfers information in one second. 1500 Baud is equivalent to about 150 characters per second. It is stated as bits per second (bps).

BINARY CODE	A code that uses zeros and ones for data. 10110011 may represent the letter C.
BIT	Binary Digit. The smallest unit of digital information thought of as representing: a yes/no choice or whether a circuit is on or off, stated as a zero or one.
BPS	Bits per second.
BRANCH	An instruction when met in a program makes a move to another part of the program deviating from the normal sequencing of the program. Branch statements are one of two types: conditional statement (command IF . . . THEN) or unconditional statement (command GO TO).
BUG	Error--be it a programming error or equipment malfunction.
BUS	Set of wires that allows data to be sent generally with microcomputers bidirectionally.
BYTE	A group of binary bits. Eight bits is equal to one byte. It takes 8 bits to form one character; so one byte is generally equal to one letter, number, or graphic symbol.
CASSETTE RECORDER	A device through which information is stored. The information is put onto the cassette as audio signals. The cassette information is stored sequentially and therefore a slower format for storage of information.
CHIP	The heart of a microcomputer, on which thousands of electronic elements are implanted. This piece of silicon, a microprocessor, contains all the circuitry to carry out the many computer operations. It is created through a photographic etching process.
CODE	The relationship between bits and a set of characters, alaphabet letters, numbers or graphic symbols. Each character has its own bit code (zero or one binary representation). The most commonly used code is ASCII.
CODING	Developing a set of computer instructions.
COMMAND	An instruction given to the computer from an input device.

COMPATIBILITY	There are two types of compatibility: software and hardware. Software compatibility refers to the ability to run programs on a variety of computers. Hardware compatibility means that various components (printers, disks, keyboards, etc.) may be connected directly.
COMPILER	A program that translates machine language into basic (everyday) English or other computer programming language and vice versa.
COMPUTER	An assembly of switches. It can be programmed to process information. Computers come in three categories. A mainframe can execute up to ten million instructions per second and costs from $100,000 upward. A mini-computer can perform one million calculations in a second and costs from $10,000 to $100,000. A micro-computer, which is what a home computer is, can carry out 250,000 instructions in a second and will cost between $100 and $10,000.
COMPUTER-BASED TRAINING (CBT)	An overall term referring to the use of computers in the training process.
COMPUTER-ASSISTED INSTRUCTION (CAI)	One application of CBT which involves an on-line interactive process between a student and a computerized delivery system in which the computer assumes a direct instructional role.
COMPUTER-MANAGED INSTRUCTION (CMI)	Another application which refers to the use of a computer to manage students' progress through a training course. A CMI system supports instructions by selecting, presenting, and scoring tests, recording student progress data, providing feedback on student drill and practice and test performance, and prescribing use of various learning resources (such as video tapes, textbooks, slide-tapes, reference materials or field visitations).
COMPUTER SYSTEM	All hardware and software necessary to meet the requirements.
CONTRACTOR	One who provides, supplies, and renders services in accordance with the terms and conditions of a contract.
COURSEWARE	Instructional material for student or instructors for CAI and CMI applications. Separate courseware is available for each course managed by the system. The courseware packages for each course may include lessons, modules, units, chapters, and objectives.

CPU	Central Processing Unit. Also known as a microprocessor, this is the main switching circuity, the brains of a computer. The CPU holds the silicon chip.
CRT	Cathode-Ray Tube. Its display screen is like the one in your TV. Also known as a monitor. The CRT is a common output device.
CURSOR	A mark on the display screen that shows where the next character will appear.
DATA	The information given to or received from a computer.
DEBUG	Process of finding, locating, and correcting errors in a program.
DIAGNOSTIC ROUTINE/ PROGRAM	A program that will check out the hardware and peripherals for incorrect information and breakdown.
DIGIT	A zero or one in the binary system.
DIRECT MEMORY ACCESS (DMA)	A technique to move data rapidly from the microprocessor to a storage device (i.e. disk).
DISK (DISC)	Magnetic coated material in a 5" or 8" record-like shape on which information and programs are started. The information is stored randomly and therefore faster than cassette storage. Sometimes called diskettes or floppy disks.
DOCUMENT	A written description of a piece of software or program or piece of equipment.
DOS	Disk Operating System. A set of programs and instructions that permit interaction between the diskettes and the microcomputer.
DOTMATRIX	A method to generate graphic characters by using dot patterns. A 5" x 7" dot matrix is a common example.
DRIVER	A program that controls the peripheral devices and how they interact with the CPU.
DUMB TERMINAL	A terminal that acts as an input/output device only.
DUMP	Transfer (or print out) memory from one area to another within a computer system.

EDITOR	A program that allows a person to change or modify a program.
ERROR	The difference between the actual response of a problem or program and desired response.
EXECUTE	The running of a computer program.
EXTERNAL STORAGE	Peripheral device for storage (i.e. tape or disk).
FILE	Collection of related data.
FILENAME	Number or letter characters to identify a file, collection of data.
FLOWCHARTING	A programming technique using shaped blocks indicating the direction and sequence of operations in a program.
FORTRAN	Science-oriented program language.
FREQUENCY	Date at which anything occurs and recurs, measured in cycles or hertz per second.
FULL DUPLEX	Reception and transmission of information at the same time.
GIGO	Garbage in, garbage out. If incorrect information is put into the computer, the output will be misinformation.
GLITCH	A burst of line noise that can cause a computer to fail or crash.
GRAPHICS	Characters used to create figures, shapes, and forms on the CBT or printer.
HARDCOPY	Data or information printed on paper distinguished from printed information or a temporary image on the computer's screen.
HARDWARE	The physical equipment that goes into a computer system. The essentials are the central processing unit, the memory and an input-output device.
HEAD	On a cassette recorder it is the area that reads information from a pre-made cassette tape.
IC	Integrated Circuit. A plastic or ceramic body with numerous leads extending from it. The silicon body protects the chip. The leads permit electrical connection of the chip to other components. The word "chip" may also be called a microprocessor.

IMMEDIATE ACCESS STORAGE (IAS)	On-line, random access storage with update capability.
INPUT	The information that you enter into your computer; what you tell the computer to do. A keyboard is a common instrument for input.
INSTRUCTION	A group of bits or a command that will make the computer perform a specific operation.
INTERACTIVE	All personal computer systems are interactive, allowing for two-way communication while it is being used.
INTERFACE	Electronic circuit that connects the CPU and a peripheral device, disk drive, etc., permitting the flow of data back and forth.
INTERNAL STORAGE	Memory system inside of the computer, rather than disk or tape storage.
INTERPRETER	A program used to translate various computer languages.
I/O	Input and output of data and information of a computer system; examples are: keyboard, floppy disk drive, printer, cassette recorder, modems, graphics tablets.
KEYBOARD	The computer version of a typewriter. When you depress the keys, which are really switches, data is fed into the memory.
KILOBYTE	The standard unit of the memory. One kilobyte comprises 1,024 bytes. (An 8K home computer, then stores 8,192 bytes of 65,536 bits.)
LANGUAGE	A format that allows a programmer to communicate more efficiently with a computer where commands will give requested actions, BASIC being one of the most popular languages.
LETTER QUALITY PRINTER	A printer which produces letter quality output utilizing either single sheet or multi-part formsets.
LOAD	Putting information into the computer's memory.
MACHINE LANGUAGE	A computer programming language that has its instructions in binary, octal or hexadecimal format.

MAIN MEMORY	That memory which is directly accessible to the computer. In a microcomputer, main memory is referred to as RAM or ROM.
MEMORY	The intergrated circuits of a computer which stores information and instructions. Each piece of information has a specific location assigned to it within the computer's memory (see also STORAGE).
MEMORY CHIP	A chip on which data is stored as electrical charges.
MENU DRIVE SOFTWARE	The availability of options by which a user is prompted to specify which functional operation(s) s(he) desires to perform within a given application.
MICROCOMPUTER	Usually included in a microcomputer is the microprocessing unit, keyboard for entering data, and a cassette recorder or disk for storing programs, and a monitor. A hardware configuration usually acquired in one of three ways: constructing several components from individual electronic parts; connecting several already-constructed components; or by purchasing a unit with built-in components. The microcomputer records information, processes it, puts it into meaningful terms, communicates it, stores it, and retrieves it.
MICROPROCESSOR	An integrated circuit that executes instruction inside the microcomputer.
MODEM	A device that makes computer information transfer over phone lines possible. It changes the tone to signals understood by the computer.
MODULATOR	A device called an RF modulator to permit a standard television to act as a video display unit.
MONITOR	A video display unit which uses a cathode ray tube to generate characters with high lines of resolution, permitting very small characters to be projected on the screen.
MOTHERBOARD	The central board or boards inside the microcomputer interconnects the various chips, and allows the interface between memory and peripheral devices.
NOISE	Inaccurate data transmission.

NONVOLATILE MEMORY	Memory that holds data even after the power has been shut off. ROM is nonvolatile.
OEM	Original Equipment Manufacturers are companies which assemble components manufactured by others and sell them as systems.
OUTPUT	The information the computer displays (on the CRT), prints, or transmits after it processes your instruction (input).
PERIPHERALS	The accessories, or options, that can be added to your basic computer, such as a printer, a disc drive, or joysticks for playing video games. Peripherals can be more costly than the basic computer.
PERFORMANCE REQUIREMENTS	This term means the performance (capacity) required by the proposed system to accommodate the specified workload and files.
PERSONAL COMPUTER	A microcomputer designed for instructional uses, entertainment, or personal recordkeeping.
PLOTTER	A device that draws on paper two dimensional shapes and designs.
PORT	The connection spot on the microcomputer where input and output devices can be connected. The most common part is an RS232 plug.
PRINTER	A peripheral device that collects output data from the microcomputer and prints it on paper. Printers are defined as impact or non-impact. Impact printers strike the paper by a ribbon-like a typewriter. Non-impact printers form characters by electrical charges, or spraying ink.
PROGRAM	A unit of discrete computer instructions which causes a computer to peform a sequence of operations. A program may contain "routines", "subroutines", and "modules".
PROMPT	An instruction or a sign from the computer that tells you what to do. For example, WAIT or BEGIN.
RAM	Random-Access Memory. This is the data that you can call up from the computer's internal storage. You can read it, change it, or erase it.
READ	The act of retrieving from memory or from an input/output device.

REGISTER	A temporary storage device located in the microprocessor which holds computer bits.
RESPONSE TIME	The time interval required for the microprocessor to respond to an instruction or input device.
ROM	Read Only Memory. A circuit where data or instructions are programmed at the time of manufacture. It allows the microcomputer to talk to us in BASIC. It cannot be erased during normal operation.
RUN	Jargon for execute.
SMART TERMINAL	A terminal that has the ability to process data and function as a computer in addition to being an input/output device for a main frame computer.
SOFTWARE	The prorams and documentations to be run on the physical equipment (hardware). The three current formats of software storage are tape (cassette), diskette, and solid state. The microcomputer loads the software into its memory to utilize the software programs.
SPIKE	A temporary sharp increase in signal or voltage.
STORAGE CAPACITY	The quality of bytes a storage unit can hold. A diskette is said to have 48-K (48,000 bytes), has approximately 48,000 characters, letters, numbers, spaces, or symbols.
STORAGE DEVICE	A peripheral device that stores information, i.e., tape or disk.
STORE	Placing information in a storage device.
TAPE	The most common microcomputer tape is magnetic, such as cassette tape. Magnetic tape is stored in electrical charge patterns that are equivalent to what we know as letters, numbers, symbols, etc.
TERMINAL	A peripheral device which allows human communication with a computer. When it is called a terminal, it is frequently tied to a main frame computer.
TRACK	Where electrical charges or characters are stored on diskettes. Some diskettes have up to 70 or more tracks on one diskette.

TURN KEY SYSTEM	Computer system packaged with proper hardware and software to be able to perform designed application upon turning it on. Many word processing systems are sold as turn-key systems.
USER FRIENDLY SOFTWARE	The ease of use of vendor-supplied software designed to facilitate data entry, screen formatting, data base definition, inquiry, and report generation. This software shall be of such sophistication that a user may learn to design screen formats, make data base queries, and generate reports (including editing and subtotaling) with a minimum of formal training.
VIDEO DISPLAY UNIT (VDU)	A part of a microcomputer similar to that of a television where information is placed on its screen.
VOLATILE MEMORY	The memory device when the electricity is turned off and the information is not retained. RAM memory is volatile.
WINCHESTER DISK	A high speed, sealed, large-capacity, magnetic storage system for microcomputers.

APPENDIX C

PART 1 - ORGANIZATIONS, ASSOCIATIONS, CONSORTIA AND NETWORKS

ACM Association for Computing Machinery
1133 Avenue of the Americas, New York, NY 10036

--ES3 is an ACM subcommittee on elementary and secondary schools

--SIGCUE - ACM's Special Interest Group for Computer Users in Education Publishes the SIGCUE BULLETIN quarterly

ADCIS Association for the Development of Computer-Based Instruction
Western Washington State College, Bellingham, WA 98225

AECT Association for Education and Communications Technology
1126 16th St. NW, Washinton, D.C. 2036

AEDS Association for Educational Data Systems
1201 16th Street, NW, Washington, D.C. 20036

AERA American Educational Research Association
1126 18th St. NW, Washington, D.C. 20036

ASTD American Society for Training and Development
Suite 305, 600 Maryland Ave. SW, Washington, D.C. 20024

CONDUIT Jim Johnson and Hal Peters
P.O. Box 338, Iowa City, IA 52240

--CONDUIT is a source of information on instructional materials and instructional applications for computers and current research projects.

ICCE International Council for Computers in Education
c/o Computing Center
Eastern Oregon State College
La Grande, OR 97850

MEAN Microcomputer Education Applications Network
Suite 800, 1030 15th Street, NW, Washington, D.C. 20005

MECC Minnesota Educational Computing Consortium
Publications Department, 2520 Broadway Drive
Lauderdale, MN 55113

--MECC has studied the use of microcomputers for both instruction and administration

NSPI National Society for Performance and Instruction
1126 Sixteenth St. NW, Suite #315, Washington, DC 20036

NWREL The Northwest Regional Educational Laboratory
Computer Technology Program
710 SW Second Avenue, Portland, OR 97204

REACT Relevant Educational Applications of Computer Technology
Technology Education Corporation
056 Sky Way, San Carlos, CA 94070

PART 2 - CBT VENDORS LIST

The following list shows both hardware and software vendors, some of whom are directly involved in packaging CBT systems. Some have supplied other hardware or software to others for use in a CBT system. This list is by no means exhaustive, but, represents vendors with which some of our members have had contact with, have seen demonstrations of or received responses from on various CBT system proposals. No inference as to the quality of the vendors listed or their products is made.

Apple Computer
10260 Bandley Drive
Cupertino, CA 95014

Bell and Howell
Audio-Visual Products Division
7100 N. McCormick Rd.
Chicago, IL 60645

Calculon Corporation
Federal Systems Group
1301 Piccard Dr.
Rockville, MD 20850

Digital Equipment Corp.
12 Crosby Drive
BU/E33
Bedford, MA 01730

Engineering Research Assoc.
1517 Westbranch Drive
McLean, VA 2210

Global Information Systems
Technology, Inc. (GIST)
201 West Springfield, Suite 1008
Champaign, IL 61820

Gould SEL
2901 West Sunrise Blvd.
Fort Lauderdale, FL 33310

Hazeltine Corporation
7680 Old Springhouse Road
McLean, VA 22102

Advanced Technology Applications
4296 Tambor Court
San Diego, CA 92124

Boeing Computer Services Co.
Education and Training Division
P.O. Box 24346
Seattle, WA 98124

Control Data
Box 0
Minneapolis, MN 55440

Emcco, Inc.
RR #3 Plaza Del Sol
Village of Oak Creek
Sedona, AZ 86336

General Technical Corp.
1101 No. Fulton Ave
Evansville, IN 477102

Goal Systems, Inc.
P.O. Box 29481
Columbus, OH 43229

Group Technology Ltd
P.O. Box 87
Check, VA 24072

Hughes Aircraft Co.
Corp. Marketing RFP Control
P.O. Box 92996
Los angeles, CA 90009

IBM
Data Processing Division
10401 Fernwood Rd.
Bethesda, MD 2034

Info III
21250 California St.
Woodland Hills, CA 91367

Logicon, Inc
P.O. Box 80158
San Diego, CA 92138

McDonnell Dougles, Inc.
P.O. Box 30204
Denver, CO 80230

Modcomp
P.O.Box 6099
1650 West McNab Rd.
Ft. Lauderdale, FL 33310

Phoenix International
P.O. Box 45165
Los Angeles, CA 90045

SAI Com systems, Inc.
2801 Camino Del Rio South
San Diego, CA 92108

Syscon Corporation
1901 N. Fort Myer Dr.
Rosslyn, VA 22209

Texas Instruments, Inc.
P.O. Box 225012, M.S. 23
Dallas, TX 75265

WICAT
2103 Gunnell Farms Dr.
Vienna, VA 22180

IIAT
20010 Centry Blvd
Suite 100
Germatown, MD 20874

Institute for Advances Technology
Control Data Corp.
6003 Executive Blvd.
Rockville, MD 20852

McDonall Douglas Corp.
1150 17th St., N.W.
Suite 500
Washington, D.C. 20036

Middle Sex Research Center
3413 1/2 M St. N.W.
Washington, D.C. 20007

On-Line Systems, Inc.
4 Professional Dr., Suite 119
Gaithersburg, MD 20760

Regency Systems
1610 Interstate Drive
Champagn, IL 61820

Symtec, Inc.
P.O. Box 462
Farmington, MI 48024

Systems Research Laboratories
2800 Indian Ripple Rd.
Dayton, OH 45440

Vision Inc.
1401 Avenue of the Stars
Suite 585
Los Angeles, CA 90067

PART 3 - CBT SYSTEMS AND LANGUAGES

This lists various authoring languages, authoring systems, instructional delivery systems and, where known, the marketing source. Again, this list is not exhaustive, but includes systems we are somewhat familiar with.

ASSET	Univac
AIS	McDonnell Douglas
CAN-8	Honeywell
CoHERE	Emcco, Inc.
DAS	DEC
eduCAItor	
Ghostwriter	
IIS	IBM
LOGO	MIT/BBN
PASS	Bell and Howell
Phoenix	Goal Systems
PILOT	
PLATO	Control Data Corporation
R2	Regency
Scholar/Teach 3	Boeing Computer Systems
Simpler	ModComp
TEHAK	University of Utah
TICCIT	Hazeltine
TUTOR	Control Data Corporation
WISE	Wicat

APPENDIX D

AGENCY PROGRAM SUMMARIES

DEPARTMENT OF LABOR

The U.S. Department of Labor's Employment service is developing CBT applications for several purposes:

Staff Training. A state agency is currently piloting for DOL a CAI module for training interviewers in small offices at remote locations. This course was developed with Bell and Howell's PASS and BASIC authoring languages. Apple microcomputers are being used, but the course will be adapted for delivery on the IBM personal computer and other microcomputers.

Testing. A DOL-funded test center in North Carolina is using Apple to score and interpret paper and pencil aptitude tests. In addition, piloting work is being done using a special high resolution CRT and the CTR microcomputer to administer and score the General Aptitude Test Battery (GATB).

Vocational and Career Guidance. Programs are being developed to provide vocational counseling through interactive CAI techniques on Apple with BASIC authoring language. Programs for persons entering the workforce will differ from those for experienced workers.

For additional information, contact:

Walter Martin
U.S. Employment Service
601 D Street, N.W., Room 8028
Washington, D.C. 20213
FTS 376-6908

BUREAU OF THE CENSUS

The Census Bureau started using CBT for training ADP personnel in 1974. Since the Bureau primarily used UNIVAC equipment for its general ADP needs, it acquired ASET, UNIVAC's Author System for Education and Training for CBT usage. At the outset, Census was a UNIVAC test site for the development and enhancement of the ASET language. Under this arrangement Census got the use of ASET at no cost plus increased support from UNIVAC.

From 1974 to January 1979, efforts were focused on the development of CAI courseware to train computer operations personnel, programmers, and other users of the ADP system. Some couse development is continuing.

The CBT effort is currently a part of the Instructional Resources and Management Section of the Computer Operations Division's User Training and Information Branch. The section is responsible for all forms of self-instruction; CBT is but one variety.

The impact of the CBT work at Census goes far beyond that location. Not only has the Bureau acted as a test site for the development of the ASET language, the courseware developed there has been distributed through the UNIVAC users' organization and the system staff of the Computer Science Center, University of Maryland, to many different UNIVAC locations.

For further information contact:

Karen H. Defazio
User Training and Information Branch
Systems Support Division
Room 3136, FO-3
Bureau of the Census
Washington, D.C. 20233
FTS 763-5562

FEDERAL AVIATION ADMINISTRATION

The Federal Aviation Administration began experimenting with PLATO CBT in September 1974 with the installation of four terminals that used the University of Illinois PLATO facility. The project has investigated a variety of CBT applications. In particular, many lessons have been developed to supplement Flight Standard courses. These lessons simulate flight inspection maneuvers, procedures, and the functions of avionics equipment. In developing these lessons, a team approach was used, combining the efforts of a subject matter expert, a lesson design specialist, and a PLATO computer author. This interdisciplinary approach proved to be the most successful approach to the development of CBT lessons.

Two lessons have been jointly developed with American Airlines. In this arrangement FAA provided hardware support, and American Airlines provided staff power to develop the lessons.

The assessment of the cost-effectiveness of these early efforts was considered promising enough for FAA to expand the project. Four additional PLATO terminals were obtained. These used the Control Data Corporation PLATO computer mainframe.

In another demonstration project PLATO terminals were installed in the seven Flight Inspection Field Offices (FIFO). These terminals were used to provide training usually given in a two-week course at the Aeronautical Center. The PLATO instruction included simulations of an inflight, on-board computer, CAI, and CMI. The favorable results of the demonstration project led to reinstallation of the PLATO Terminals. Additional courseware is being developed and delivered via these terminals.

The accelerating use of CBT in the aviation industry was recognized by FAA management. As a result, FAA initiated a comprehensive study of its training requirements and how CBT might be used to cost-effectively fulfill some of these requirements. The study was a joint effort of Training Programs Division and the Office of Management Systems.

This study followed the approach specified by the FAA internal regulations on the acquisition of ADP systems. The project specified training requirements, identified feasible alternative CBI systems that will meet the training requirements, evaluated the costs of feasible alternatives, and compared the findings with the existing training system. The study results were favorable, and an interim system proposal, written and approved in April 1979, was implemented. This interim system includes a total of 70 PLATO terminals located at the FAA Academy and at Airway Facility sectors. Nine courses for electronics technicians, representing about 20 percent of the Airway Facilities training workload, will be handled by the system. An expanded system is under consideration involving the lease of 350 terminals and the extension of service to air traffic control centers.

For additional information, contact:

John Buck
Technical Training Branch, APT-340
Federal Aviation Administration
800 Independence Avenue, N.W.
Washington, D.C. 20591
FTS 426-8865

VETERANS' ADMINISTRATION

The Veterans' Administration has developed substantial CBT courseware for ultimate use in training users of VA's new data processing system called TARGET. This system is a nationwide computer network for manipulating and maintaining veterans' benefit data. The system is used for inquiry, updating

records, and producing benefit payments. Honeywell computers are located in each of three VA regional data processing centers. These computers support about 3000 terminals and 500 printers nationwide.

About 10,000 VA personnel work with this sytem and were trained initially in its use. These employees are distributed in 58 offices among the three regions throughout the country. After experimenting with various modes of training, VA concluded that the most effective way is to train on the terminal equipment that employees will actually be using on the job.

The CAI courseware was developed by the User Education Division of the Benefits Delivery Systems Support (BDSSS). At the time the CAI courseware was developed, this division consisted of seven permanent staff and about seven detailed subject matter experts who assisted in lesson development. Maintenance of CBT courseware is now accomplished by BDSSS Management Staff, which was merged with the User Education Division. Three staff members' time is devoted to maintenance of CBT courseware.

VA did its lesson development using SPEAR, a courseware language developed uniquely for the system. SPEAR (Subsystem for Programed Education and Review) is written in COBOL 74 and was designed especially for the VA's claims processing system.

There are currently about 40 CAI lessons available for use in 58 regional offices. Since all regional offices have completed initial training for installation of the system, the program is currently being used for replacement training. There are no plans for expansion of CBI.

For additional information, contact:

Leslie Schuman
810 Vermont Avenue, N.W.
Veterans' Administration
Washington, D.C. 20420
FTS 389-5375

INTERNAL REVENUE SERVICE

IRS has 75,000 employees, or whom some 5000 are located in Washington, D.C., and the balance in seven regional offices, ten service centers, 58 districts, and 200 local posts of duty. Responsibility for training is centralized in Washington under the director of the Training and Development Division, who reports to the Assistant Commissioner for Human Resources. Most training is performed at nine regional training centers, except for special agents, all of whom receive training at Glynco, Georgia.

Revenue officers, revenue agents, tax auditors, special agents, and taxpayer service representatives receive basic and advanced technical training to qualify them to perform their jobs. They are also exposed to periodic updating training. Clerical and data processing employers also receive technical training. Managerial and executive training is provided at all levels from first-line supervisor to senior executive service. Over 500 courses are taught, 95 percent of which are developed in-house. A typical technical recruit training program consists of one week of preclassroom orientation at the post of duty, seven weeks of classroom training at a training center, and six weeks of on-the-job training (OJT) at the post of duty. Preclassroom training is supported by self-instruction booklets, videotapes, a leader's guide, and a trainee progress system record. Classroom training is conducted in traditional manner with student texts, an instructor's guide, detailed lesson plans, videotapes, and slide tapes.

CBT has been in use since 1975, beginning with the purchase of one PLATO terminal from the University of Illinois. The system was expanded to four terminals and then to 19. For the year ending June 30, 1982, costs of CBT operations were $248,000 and benefits were calculated at $789,000 for a net benefit of $544,000.

The present computer system (PLATO) primarily supports assembled classroom training operations through the following applications:

1. Centralized test banks of test questions for most recruit and some advanced technical training programs.
2. Scheduling of interregional and regional classes.
3. Data analysis of questionnaires and evaluations.
4. Compiling of training course requirements and budgeting for regional training needs and headquarters work plans.
5. Electronic mail.
6. Incidental use of CAI, utilizing PLATO catalog and self-authored courses, for experimental purposes.

Beginning in 1981 the IRS Training Division has been working on redesigning their instructinal system model to improve the effectiveness and efficiency of IRS training. The new design model calls for decentralizing training to about 200 sites nationwide. Training which can effectively be done in a self-instructional format (about 50% of all training) can then be moved to local

PODs, thereby saving travel and perdiem costs. To maintain control and increase flexibility in lesson delivery a computer system will be needed to perform CMI and CAI functions, as well as other data management and communications functions.

The PLATO system which IRS currently uses could perform most of the new requirements, but would be astronomically expensive. Other methods for meeting our needs are being explored.

An RFP was released in February 1982 to lease a prototype CBT instructional system for a one region (7 sites) test of the new model with an technical recruit course, Revenue Agent I. None of the vendors submited responsive proposals at that time. A test of the new course material is now scheduled for January 1983 using the PLATO system at 2 sites. Work continues on writing a new RFP for the nationwide computer system.

For futher information on the current system, contact:

Joyce Davenport
IRS-/ _ining and Development Division
2221 Jefferson Davis Hgwy, Room 306
Arlington, VA 20202
(703) 557-2456

For information on proposed new system, contact:

Lori Gillespie
(same address and phone as above)

U.S. SENATE

The U.S. Senate Computer Center provides computer services to each senator through Hazeltine 1510 terminals located in the senator's Washington office and in up to two state offices. Currently a total of 109 state sites. The center is also responsible for training senatorial staff members in the use of these computer services.

The central processor is an IBM 168 with attachments. Using IBM's Interactive Instructional System (IIS) software, the center has developed 10 CAI lessons which require an average of 20 hours to complete for training users of the Correspondence Management System and the Legislative Information System. These lessons are replacing and supplementing classroom training. Seven additional lessons are under development. The staff that prepares CAI lessons consists of four instructional writers and one IIS programmer/administrator. Some 300 hours of development time (from task analysis through evaluation and revision) is required for each lesson hour, but this ratio is improving with experience.

A formal evaluation of the program has been completed, which found the CAI instruction to be as effective as classroom instruction and preferred by 90 percent of the trainees. Student training time has been cut by 40 percent. Travel of training staff has been cut by 50 percent. Development costs are paid off in approximately two years.

For further information, contact:

Marian Saunders
U.S. Senate Computer Center
400 N. Capitol Street
Washington, D.C. 20510
(202) 224-3127

ARMY RESEARCH INSTITUTE FOR THE BEHAVIORAL SCIENCES

The Basic Skills Instructional Systems Technical Area of the U.S. Army Research Institute conducts research on the application of computer technology to training problems. Several projects have been initiated to improve soldiers' basic skills. The computers and instruction used in these efforts range from PLATO with approximately 50 hours of basic skills lessons to a hand-held device being designed to teach and drill military vocabulary. Computers are being used for information purposes as in AREIS, the Army Education Information System. AREIS is a microcomputer-based Army career and educational system designed to support Army Education Center counselors. These projects and others involve research on the design, development, and evaluation of computer-based systems which support the Army's training requirement.

For further information contact:

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5001 Eisenhower Ave.
Alexandria, VA 22333
(703) 274-8876

APPENDIX E

TABLE OF CURRENT CBT ACTIVITES IN FEDERAL TRAINING

	Program Category				Program Status				Instructional Strategies						Hardware			
	CMI	CAI	Comp. Gen. Tests	Other	Study	Prototype	Operational	Subject Areas	Problem Solving	Drill & Practice	Tutorial	Inquiry	Simulation	Gaming	CPU	Terminal	Operating System	Software/Programming Authoring Language
Agriculture Dept. APHIS, PPQ		X	X		X			Regulatory Decision Making, Technical		X	X				Apple II	MEC	Disk II	BASIC, GENIS, CDSI, etc.
Air Force Human Resource Laboratory	X	X	X	(1)	X		X	Technical, System specific	X	X	X	X	X	X	Intel 8086	Plasma VT-125	Cyber Scope 3.4	CAMIL, ADA, Pascal
Air Force, Air Training Command	X	X	X			X/	X	Technical	X	X	X	X	X	X	Various	IST III Viking	Plato, TICCIT, AIS	TUTOR, BASIC, CAMIL PASCAL, ADA
Army Missile and Munitions Center		X					X	Technical skills		X			X		CDC	IST II Micro Plato	NOS	TUTOR
Comptroller of the Currency	X	X	X		X			Technical skills										
FAA	X	X	X		X		X	Technical skills	x	X	X	X	X		CDC, Fla. State	PLATO	PLATO	TUTOR
FEMA, National Fire Academy		X			X			Fire Service Management		X			X		Apple II	Apple II	Apple DOS	PILOT
HUD	X						X								UNIVAC 1100		Exec 8	COBOL
Internal Revenue Service	X		X		X	X	X	Technical skills, Clerical, Data Processing, Data analysis, Scheduling,		X	X				CYBER 170-730	CDC IST 1, 2,63	PLATO	TUTOR
Interior Department		X			X			English, managerial skills	X	X	X							

TABLE OF CURRENT CBT ACTIVITES IN FEDERAL TRAINING (con't.)

	Program Category				Program Status				Instructional Strategies						Hardware			
	CMI	CAI	Comp. Gen. Tests	Other	Study	Prototype	Operational	Subject Areas	Problem Solving	Drill & Practice	Tutorial	Inquiry	Simulation	Gaming	CPU	Terminal	Operating System	Software/Programming Authoring Language
Labor Department, U. S. Employment Service		X					X	Data gathering skills		X	X				none	none	Bell-Howell DOS-modifed	PASS
Labor Department Employment Standards Admicis.	X	X	X		X													
HHS, National Institue of Health		X			X			Procurement							IBM	IBM 3278		COBOL
HHS, Lister Hill				(2)		X		User on line catalog training							IBM 3033 MP	HP 2626A	MVS	PL/1 ALC
Center		X				X		Dental-oral pethology					X		Apple II	Apple II	Apple DOS	Lister Hill Pilot Applesoft, BASIC
OPM, Instructional Systems and Technology	X	X	X			X	X	Computer literacy FORTRAN COBOL	X	X	X		X	X		PLATO Etc.		TUTOR, etc.
Senate Computer Center		X				X	X	Word Processing, data entry and retrieval		X	X		X		IBM 370 Model 1158	Hazeltine 510	CISC OS/V52	IBM Coursewriter
Social Security Admin.		X			X	X		Technical, managerial and common needs			X				DEC 20/20	Concept 100		LOGO, LISP
Veterans Administration (1) Materials Development (2) Online Search Assistence		X					X	Claims processing	X	X			X		Honeywell 66/80	Honeywell 7760	DM IV	SPEAR

APPENDIX F

LIST OF IGCBT ORGANIZATIONS AND CONTACTS

Organizations on Appendix E Table of CBT Activities

U.S. Department of Ariculture APHIS, PPQ Professional Development Center 195 Thomas Johnson Drive Frederick, MD 21701	William O. Wade, Jr. (301) 663-8585 FTS 933-1270
Air Force Human Resources Laboratory Lowry Air Force Base Denver, CO 80230	William A. Nunns (303) 370-2775 AV 926-2775
U.S. Air Force Air Training Command Randolph Air Force, Base TX 78150	Frank Schufletowski (512) 652-3274
U.S. Army Missile & Munitions Center School Redstone Arsenal Huntsville, AL 35897	John P. Carrigy AV 746-1820
Comptroller of Currency Washington, DC 20219	James R. Wingrove (703) 389-4234
Federal Aviation Agency Technical Training Branch APT-310 800 Independence Ave Washington, D.C. 20591	John Buck Barbara Wright (202) 426-8865
Federal Emergency Management Agency National Fire Administration 1825 S. Seton Ave Emmitsburg, MD 21727	Michael D. Fay (301) 447-6671
Department of Housing & Urban Development 451 7th St. SW Washington, D.C. 20410	Marybeth Budd (202) 755-5184
Internal Revenue Service Training & Development Division 2221 Jefferson Davis Hwy, Room 306 Arlington, VA 22202	Lori Gillespie (703) 557-2456
Department of Interior, PPM 18th & C Streets Washington, DC 20240	Phyllis S. Jones (202) 343-8616

U.S. Employment Service 601 D Street NW Washington, DC 20213	Walter J. Martin (202) 376-7497
Depatment of Labor Employment Standards Administration Div. of Personnel Development & Training Washington, DC 20210	Brendan Branley (202) 523-7036
Lister Hill Center for Biomedical Communication National Library of Medicine, NIH Bethseda, MD 20209	Craig Locatis J. P. Toothman (301) 496-6280
National Institutes of Health Training Assistance Branch Bethesda, MD 21701	Milt Tipperman
Office of Personnel Management Instructional Systems and Technology 1121 Vermont Ave NW Washington, DC 20044	Larry Westberg Patrice Walker Jack Weaver (202) 653-7055
U.S. Senate Computer Center Educational Services & Support Section 400 N. Capitol St. Washington, DC 20570	Marian Saunders (202) 224-3127
Social Security Administration Office of Training 6401 Security Boulevard Baltimore, MD 21235	Ray Halverson Rubin Shulik (301) 594-4526 FTS 934-4526
Veterans Administration 810 Vermont Ave NW Washington, DC 20420	Leslie Schuman (202) 389-5796

Other Organizations Represented in IGCBT

U.S. Army Research Institute for the Behavioral and Social Sciences
U.S. Army Training and Doctrine Command
U.S. Army Logistics Management Center
Centers for Disease Control
U.S. Coast Guard
U.S. Customs Service
Defense Communication Agency
Defense Languae Institute Foreign Language Center
Depatment of Energy
General Accounting Office
Gould S.E.L.

Government Printing Office
HumRRO
Institute for Defense Analysis
Instructional Communications, Inc.
Oak Ridge Associated Universities
U.S. Postal Service
Soil Conservation Service